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ABSTRACT

The final report presents summary data on the accomplishments of a project serving deaf-blind children who were also severely, multiply handicapped. The project operated a model clas' 'oom for six to eight students in a San Francisco public school to develop and demonstrate innovative educational practices and assessment systems for visual and auditory functioning. Five major components of the project are analyzed separately, and evaluation data for each component are presented: (1) model classroom component (application of operant principles to sensory assessment); (2) innovative practices (including the use of a continuous correction error-correction procedure and the development of an expressive manual signing curriculum); (3) products (assessment and program manuals); (4) inservice training and workshops (intensive individualized inservice, training workshops, and informational presentations); and (5) dissemination (workshops and replication of the project's model classroom). (CL)

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FINAL REPORT

Bay Area Severely Handicapped Deaf-Blind Project

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Funding Source: U. S. Office of Education
Bureau of Education for the Handicapped
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FINAL REPORT

Bay Area Severely Handicapped Deaf Blind Project

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The Bay Area Severely Handicapped Deaf Blind Project was a model educational project serving deaf blind children who were, in addition, severely, multiply handicapped. Because severely, multiply handicapped children are so difficult to assess, intact hearing and vision is often simply assumed in the absence of data to the contrary. In other instances, the opposite is assumed, when in fact the perceptual modality is intact but is not utilized by the child in relating to the environment. It is for these types of children that the project was conceived.

The project operated a model classroom for 6-8 students in a public school classroom in San Francisco. The major goals of the project were to develop innovative educational practices and assessment systems for visual and auditory functioning in this population. The project was committed to a non-segregated service delivery model and returned students to their original severely handicapped classrooms after 6-8 months of assessment and IEP reformulation in the project classroom. A two week intensive inservice training program was then provided to the child's original teacher.

The major components of the project include the following: 1) Model Classroom Component, 2) Innovative Practices, 3) Products: Auditory and Vision Assessment and Program Manuals, 4) Inservice Training and Workshops, 5) Dissemination. Each of these components is discussed below. Included under each component is a discussion of the evaluation of that component and recommendations for future activities, investigation and research.

1) MODEL CLASSROOM COMPONENT

During the 2½ years of its existence, the classroom served 13 students from two Bay Area Counties. The instructional format used in the classroom was data-based instruction derived from operant models of human learning. This model requires that each instructional objective be task analyzed into the discrete steps of behavior leading to successful skill performance. These steps are then taught using a discrete trial format in which a specific cue is provided, the learner performs the target action or behavior, and specific consequences result for the learner. Specific teaching strategies are employed to correct incorrect responses and/or to facilitate acquisition of new behaviors, including prompting, shaping, modeling, errorless stimulus control, etc. Performance data on each objective are gathered daily and monitored to indicate needs for program modification and/or successful completion of the objective. Table 1 presents a sample gross motor objective and task analysis for a project student. Figure 1 presents this student's performance data. Further sample IEP objectives and their corresponding task analyses, teaching strategies and performance data from project students can be found in Chapter V of the Auditory Manual developed by the project and in previous progress reports.

Task analytic, data based instruction utilizing principles of applied behavior analysis has been described in detail in the literature (Kazdin, 1975; Axelrod, 1977; Gaylord Ross, 1980) and has been the basis of numerous curricula and teacher training texts for the severely handicapped (cf. Brown, et. al., 1975; Snell, 1978; Sailor, Wilcox, and Brown, 1980). Thus, use of this model in the Deaf Blind Classroom was in itself not an innovative proctice. However, the classroom expanded use of this model into innovative educational practices in several ways.

First, application of the operant instructional model in severely handicapped classrooms has, in general, been restricted to traditional curricular domains such as gross and fine motor development, self-help skills, independent living and pre-vocational skills, communication development, and leisure and social skills. In addition to these domains, the project classroom expanded use of all the components of this instructional model to the new domain of sensory assessment and programming for vision and audition.

While curricula for visually handicapped and deaf-blind students have long emphasized visual and auditory functioning as critical <u>content</u> areas for instruction, the recommended format of this instruction has frequently been "sensory stimulation" (Barraga, 1970) rather than contingent instruction. Thus, emphasis has been placed largely upon the stimuli and cues used during teaching, rather than upon the consequences that accrue to the student contingent upon specific visual and auditory behaviors. Rather than focusing upon providing opportunities to passively <u>receive</u> sensory input, application of an operant instructional model to sensory domains represented an innovative practice which focused upon the <u>consequences</u> to the student of functional vision and hearing use. As an example of the application of operant instruction to sensory content, Table 2 presents a task analysis for teaching visual tracking taken from the project classroom. Figure 2 presents actual student performance data. Detailed discussion of the innovative practice of applying operant instruction to vision and audition is found in Section 2 of this report.

Further innovative components of the instructional model used in the classroom related to specific innovative teaching practices within the operant

PUSH TO SITTING

Behavioral Objective: When lying A)in supine; or B) in side lying; the student will be able to push herself to sitting using either arm to a criteria of 80% on 2 out of 3 days or 100% for one day.

Materials: Mat or rug

Setting: lying on a mat or a rug at home or in the classroom

Teacher Does	Student Does
For each step: position the student in A)supine; or B) side lying; and give the cue,"up", and tap her at the shoulder designated on the data sheet:	
1. Take the arm designated on the data sheet and pull up (diagonally if in supine). Keep pulling only as Michele pushes up on the other arm. Reinforce a correct response with social praise and a toy.	1. The student must help to push up on her elbow and hand as teacher pulls him/her to sitting.
2. Take the arm designated on the data sheet and pull up until he/she has the elbow resting on the floor. Continue to hold her hand but do not pull it. Same reinforcement.	2. The student must finish pushing to sitting.
3. Take the arm designated on the data sheet and tug at it until the student moves his/her arm into place. Continue to hold her hand but do not pull. Instead, move as she moves.	3. The student must push herself to sitting from the point at which she has her arm in place.
4. Take the arm designated on the data sheet and tug at it. Continue to hold the student's hand but give no further assistance.	4. The student must push herself to sitting.
5. Take the hand designated on the data sheet and give no other cue.	5. The student must push herself to sitting.
6. After first cue, give no further assistance.	6. The student must push herself to sitting.

OBJECTIVE COMPLETE

Table 1

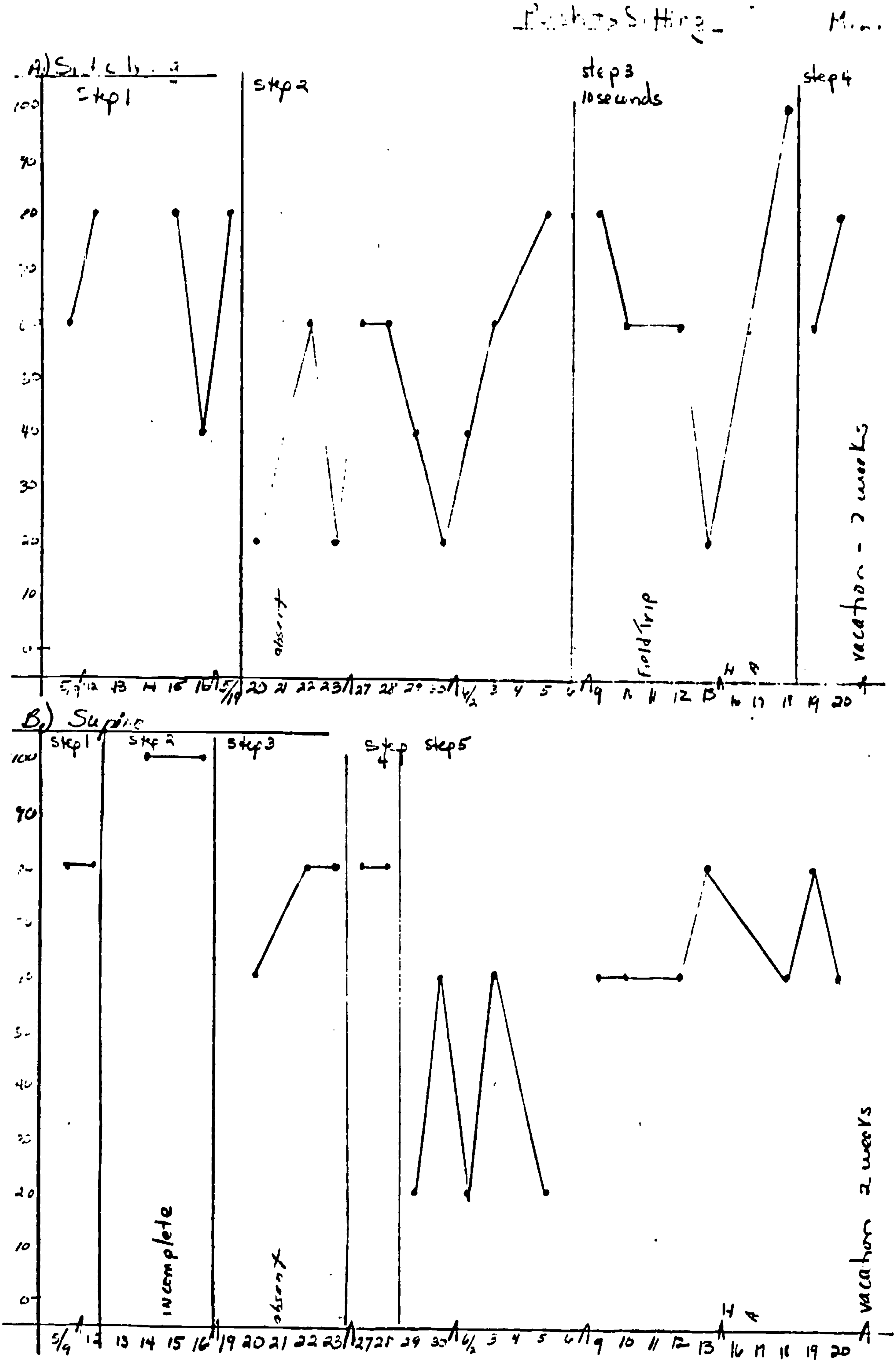


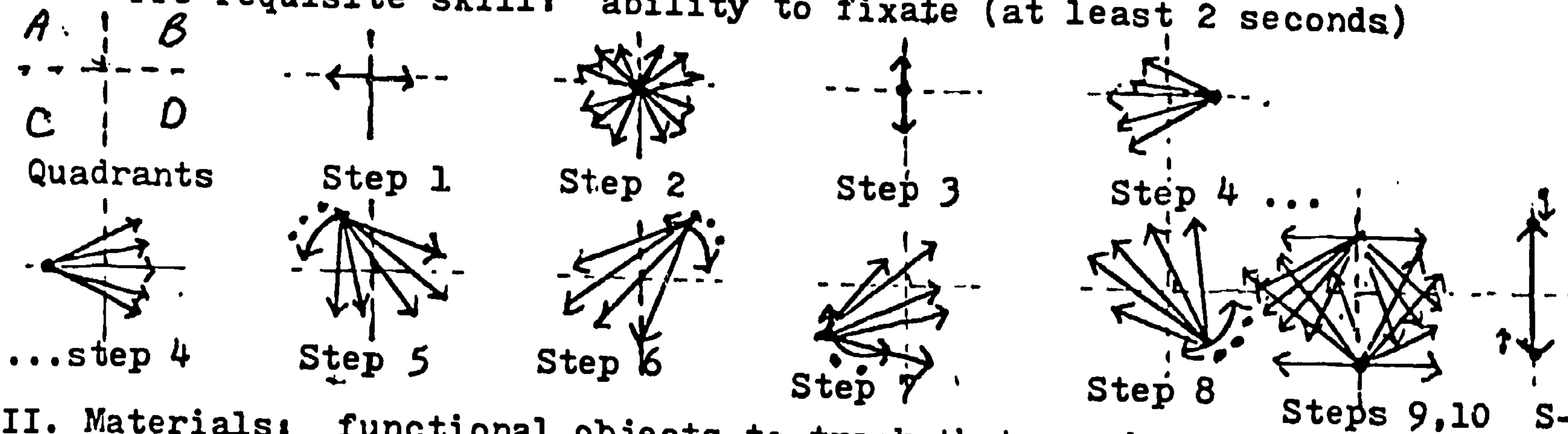
Figure 1

Kathleen Gee

I. Behavioral Objective

When an object is moved in a horizontal, vertical, or diagonal direction -- starting at midline and eye level, or from points to the right, left, and above or below midline, crossing midline and eye level -- to points outside the students' arms' reach (see diagrams and quadrants below); the student will track the object, fixate on it at rest and remain fixating while reaching for and grasping the object to a criterion of 80% for 2 out of 3 days or 100% for one day out of the designated number of trials.

Pre-requisite skill: ability to fixate (at least 2 seconds)



II. Materials: functional objects to track that can be used in other curricula such as fine motor, communication, self-help, etc.; shelves, tables nearby for placing objects; data sheet, pencil

III. Setting: classroom or other school or community setting with places available to place the objects

IV. General Procedures:

This procedure should always be done in conjunction with another program in order to avoid purposeless tracking and resulting boredom. The object should be used in some way after it is tracked and picked up by the student. For example, a fine motor skill such as hanging a cup on a hook could follow tracking a cup with a handle. The tracked object could also be used in a communication program or a self-help program. For example, the student could track his toothbrush, reach for it, pick it up, then brush his teeth. After brushing, he could track it again, pick it up, and place it in the toothbrush holder (a visual-motor task).

Training Procedures: The student should sit across from the teacher in a chair. A desk is not necessary. The teacher should tell the student to stand up and then present the object. (If the student is non-ambulatory he or she may remain seated in an upright position). Say and/or sign, "Look." After fixation occurs the object should be moved in the direction indicated on the data sheet and placed on a shelf or table level with the final point just beyond arm's length. The student should track the object the entire way. If he or she discontinues tracking prompt the student back on task and begin again. Note whether the eyes move symmetrically on the data sheet. When the object stops the student must fixate on it and them remain fixating while reaching for the object. Again, as soon as the student ceases fixating, prompt him or her back on task and start that section over again until it is done correctly. Note whether or not the reach is accurate on the data sheet and any obvious position of the eyes or head while reaching.

V. Data and Graphing: 5 kinds of data are kept. Data is recorded with a (+) for correct or (-) for incorrect. If the response is incorrect follow the correction procedures stated above and record the number of times the presentation of stimulus or other task had to be repeated.

Data is taken on 5 things:

1. tracking of the object,
2. fixation on the object after it stops moving,
3. reaching while remaining fixated on the object,
4. whether or not the reach is accurate,
5. whether or not the eyes move symmetrically;

and each is graphed in 2 ways. The % correct is recorded and the average number of times the student had to have the task repeated prior to a correct response. Number 5 is simply recorded as + or (-) and graph with percent only. It may not be necessary to keep #5 data

(Data for the curriculum which follows the tracking is described in that particular program.)

Note: This program can be adapted as needed. Information gathered during the progress of this program may tell the teacher that the student has no peripheral vision, for example, or that one eye is unable to track from above midline, etc. The teacher should adjust as necessary.

Following is a task analysis for the order of presentation of stimulus and a data sheet.

Bay Area Deaf/Blind Project

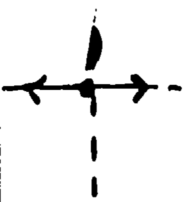
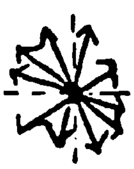
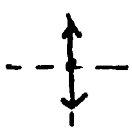
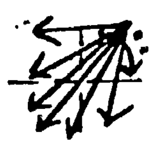
Teacher	Student
 1. Move object from midline right or left to points along eyelevel just at arms reach. (If necessary use a-c to train the tracking response. Probe for the student's ability and if no assistance is needed begin student at step 1c.) a. completely prime the student through tracking the object and reaching for it. b. give intermittent physical priming through tracking. c. give no physical assistance. (The student may need to be taught the reach response as well.)	1. Student must track object, fixate on it, and remain fixati while reaching for and grasping it. a. when physically primed through tracking and reaching; b. when given intermittent physical priming through tracking; c. when given no physical priming.
 2. Move the object from midline at eye level to points just at arms reach within quadrants A,B,C, or D but never at more than a 75 degree angle.	2. Student must track object, fixate on it, and remain fixati while reaching for and grasping it.
 3. Same as above but move object vertically above or below eye level.	3. Same.
 4. Move object from the right at eye level to A or C quandrants; or from the left at eye level to B or D quadrants. 	4. Same.
 5. Move objects from points in the A quadrant to points in B,C, or D quadrants.	5. Same.
 6. ---from quadrant B to points in A,C, or D;	6. Same.
 7. ---from quadrant C to points in A,B, or D;	7. Same.
 8. ---from quadrant D to points in A,B, or C.	8. Same.
 9. Move objects from midline above eye level to points in all quadrants.	9. Same.
 10. Move objects from midline below eye level to points in all quadrants.	10. Same.
 11. Move objects from above or below midline vertically, passing eye level and reaching the opposite point.	11. Same.

Table 2

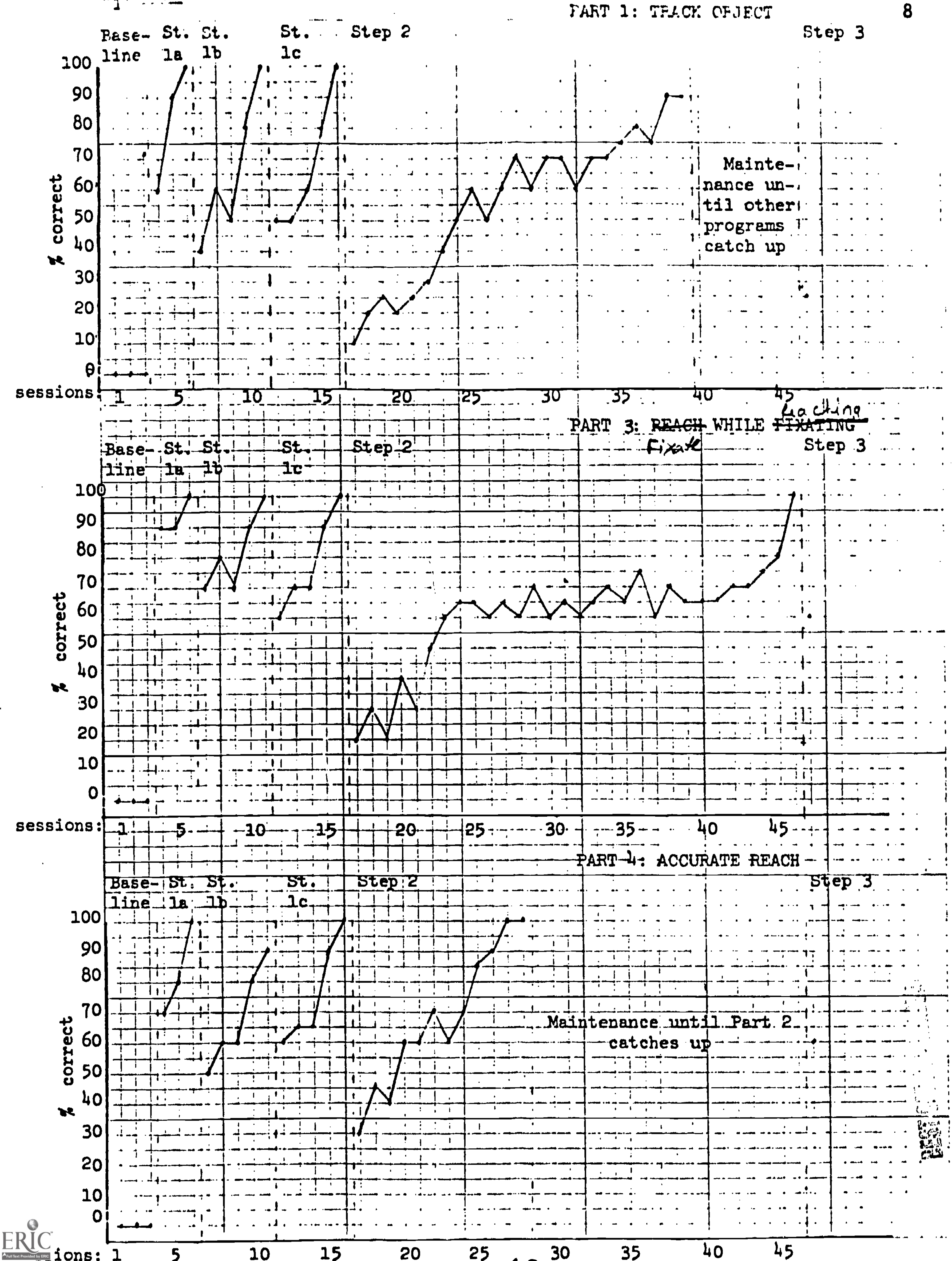

PART 1: TRACK OBJECT
Base- line
St. 1a
St. 1b
St. 1c
Step 2
Step 3
100
90
80
70
60
50
40
30
20
10
0
% correct
Mainte- nance un- til other programs catch up
sessions: 1 5 10 15 20 25 30 35 40 45
PART 3: ~~REACH~~ WHILE ~~FIXATING~~ Fixate Reaching
Base- line
St. 1a
St. 1b
St. 1c
Step 2
Step 3
100
90
80
70
60
50
40
30
20
10
0
% correct
sessions: 1 5 10 15 20 25 30 35 40 45
PART 4: ACCURATE REACH
Base- line
St. 1a
St. 1b
St. 1c
Step 2
Step 3
100
90
80
70
60
50
40
30
20
10
0
% correct
Maintenance until Part 2 catches up
sessions: 1 5 10 15 20 25 30 35 40 45

Figure 2

model. One innovative operant teaching practice was the use of functional curriculum sequencing (Holvoet, Guess, Mulligan and Brown, 1980) to teach IEP objectives. A second was use of a specific innovative error correction procedure during instructional sessions. Both of these practices are also discussed in further detail in Section 2 below.

Evaluation of Model Classroom Component. Students served in this project were functioning at extremely low levels of adaptive bahavior. Although students were evaluated with the Michigan Deaf Blind Scale, this scale was not fine enough to pick up differences in child behavior over the 6-8 month time that students were in the classroom; furthermore, statistical analysis is not possible with the data from this assessment instrument. Therefore, two alternative evaluation measures were used. One was the overall acquisition rate of IEP objectives in the classroom. This information is presented in Table 3. The type of objective is categorized into three types: visual, auditory, and other objective. In this way performance can be separately analyzed into the two main sensory domains of the project (audition and vision) as well as performance in other curricular domains, e.g., self-care, communication. In the tabulation, each short-term objective was scored 1.0 if it was completely mastered. If part of the objective was completed, a score ranging between 0 and 1 was given. For example, if a pupil completed 3 steps on a 10-step task analysis, with the terminal step equivalent to the short-term objective, a score of .3 was given. The total number of IEP objcctives were then tabulated in each of the three domains. In addition, the percentage of objectives mastered from the IEP is presented. In some cases further instructional objectives were set after the objectives on the IEP were exhausted. Performance on additional objectives appears in Table 3.

These data indicate an overall IEP acquisition rate of 77%. While comparable data frcm other classrooms is not available, this figure does validate that learning was occurring at a consistent rate in the classroom, and that over 85% of all vision and hearing IEP objectives were mastered in the project classroom.

The second form of evaluation was documentation of increases in auditory and visual efficiency in project students through accomplishing appropriate assessments and, where needed, providing aids in the form of amplification devices and/or glasses. Table 4 below summarizes this information:

Table 3
IEP Objectives Attained

Pupil	IEP V	IEP A	IEP O	Additional V	Additional A	Additional O	Total V	Total A	Total O
MM	1/100%	1/100%	3.3/83%	1/100%	1/100%	6.4	2/100%	2/100%	9.8
CO	1/100%	1/100%	5.6/93%	1.1/55%	0	12.9	2.1/70%	1/100%	18.5
MR	5/100%	1/100%	19.2/91%	0	0	17.4	5/100%	1/100%	36.7
ML	1/100%	1/100%	11.2/66%	1/100%	1/70%	3.3	2/100%	1.7/85%	14.6
ME	1/100%	1.7/83%	6.9/76%	0	0	7.8	1/100%	1.7/83%	14.7
BC	0	0	2.6/42%	0	.6/66%	.25	0	.6/66%	2.8
DS	0	0	12.8/80%	0	0	2.9	0	0	15.7
YC	0	3/100%	11/74%	0	2	.7	0	5	11.7
JD	0	0	15.5/78%	.3	1	2.5	.3	1	18.0
HM	1/100%	.2/20%	14.8/87%	2	0	5.4	3	.2	20.2
TZ	1/100%	1/100%	10.1/77%	0	0	1.9	1	1	12.0
Total Attained	11	9.9	113	5.4	5.6	61.45	16.4	15.2	174.7
Percent Attained	100%	88%	77%						

Note. In IEP columns numerator indicates number of objectives attained; denominator indicates percent IEP objectives attained. Numbers in the Additional and Total columns indicate the number of objectives attained.
0 = no objectives set for that domain; therefore no percent calculated in the IEP columns.

Table 4

Students without formal assessment at entry:
Vision 4/14=28% (JD, MM, BC, JM)
Audition 6/14=43% (JD, C, JM, MM, TZ, HM)

	First formal ass.	First aides	Firm decision agst. aides
Vision	2 (JD, MM)	2 (ML, MR)	------------
Audition	4 (JD, BC, HM, TZ)	2 (JD, HM)	4 (ML, TZ, BC, ME)
Total	6 = 43%	4 = 28%	4 = 28%

Nearly half the students received their first formal hearing or vision assessment through the project's efforts; a third of the students acquired their first hearing aids or glasses through the project.

It is recognized that the above data do not meet the criteria for experimental validation of the classroom component of the project. However, in conjunction with experimental validation of specific innovative practices below, it is clear that the project classroom did result in improved auditory and visual functioning in the students it served.

Recommendations. The classroom outcomes of this project strongly suggest that instructional needs of severely, multiply handicapped students with sensory deficits can be met by using data based, systematic instructional strategies typically found in classrooms serving mentally handicapped students. These strategies can be readily extended to the content areas of vision and audition. This outcome is consistent with a non-categorical service delivery model. Galloway and Osteen (1981) have reported similar findings in their report to OSE concerning issues in service delivery to deaf-blind children. It is the recommendation of this project that deaf blind students who are in addition physically handicapped and severely/profoundly retarded be served in severely handicapped classrooms by teachers proficient in an operant, data-based, task-analytic instructional format.

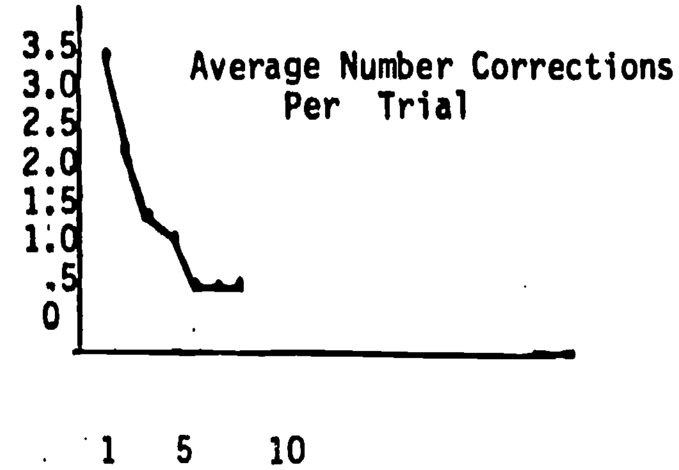
It should also be noted that in addition to the 14 students served directly by project staff in the project classroom, during the final 9 months of the project, project staff worked directly with an additional 15 students on a sustained basis as part of product validation efforts. Thus, a total of 29 severely handicapped/deaf-blind students received direct instruction on vision and hearing objectives from project staff using project programs and procedures.

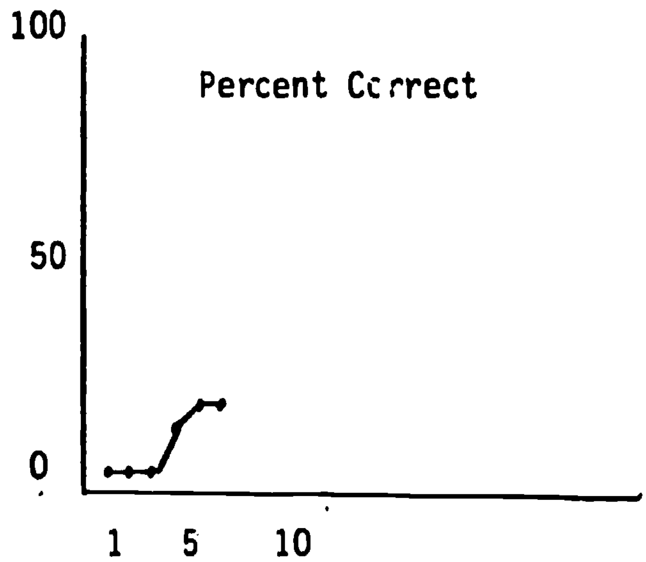
2) INNOVATIVE PRACTICES

Innovative educational practices developed by the project include the following: 1) use of a "continuous correction" error correction procedure; 2) use of individual functional curriculum sequencing; 3) application of operant stimulus control and errorless learning principles to the domains of sensory assessment (VRL and OMR assessment programs to prepare students for audiological assessment; within stimulus shift errorless training program for measuring far point acuity); 4) development of an expressive manual signing curriculum.

Continuous correction error correction procedure. As described in previous progress reports, the continuous correction procedure involves repeated presentations of the instructional trial until the student makes the correct response designated in the task analysis. When a student performs incorrectly or makes no response on any one trial, the teacher marks a (-) and demonstrates the correct response. The student is then given the trial over again and the correct response is required. If the student performs correctly this time the teacher marks a number 1 next to the (-) to show that the initial response was incorrect and it took one more time to achieve a correct response (-1). If the student did not perform correctly the teacher demonstrates the correct response again and repeats the trial until the correct response is performed. Scores may be (-10), (-21), (-3), etc.

Two graphs are kept of these data. One graph shows the percent correct out of initial responses over a set number of trials. For example, if the student does 10 trials per day on a specific skill and s/he got 5 of the responses to initial presentations of the stimulus correct the graph would show 50%. The other graph shows an average number of repetitions per trial prior to the correct response. Using the above example again, the student would have performed incorrectly on 5 initial responses. If these scores were (-3), (-2), (-5), (-1), and (-1), the total number of repetitions would be 12. Since there are 10 trials, 12 is divided by 10 and the average number of repeats per trial is 1.2. As the percent of initial correct responses goes up, the average number of repeats typically goes down. The graphs below represent typical data using the correction procedure.





This procedure was used with a significant number of instructional programs in the classroom and is considered to be a major factor in the classroom outcome data reported in Section 1. A detailed analysis of classroom data documenting the effectiveness of this procedure in establishing visual attention in the classroom was included in the January, 1980 progress report.

In addition, the effects of the continuous correction procedure in establishing generalized visual attending were experimentally evaluated in a single case design (Goetz, Gee, and Sailor, Note 1) with two project students. The major research questions in this study were:

1) Can visual attention to visual motor tasks be established in low vision severely handicapped students using a continuous correction procedure?
2) Can generalized visual attention be established through a training sufficient exemplars strategy using the continuous correction procedure?
3) If generalized visual attending is established, what are the correlated effects upon skill acquisition of specific visual motor tasks?

Subjects: The two students who participated in the study were M.E. and M.L. M.E. was a 3½ year old severely retarded girl and M.L. was a 7 year old severely retarded girl. Both students had had surgical removal of cataracts and acuity levels were unknown. M.L. had a moderate hearing loss in one ear. The dependent variables in the study were as follows: 1) Acquisition of visual attention, defined as continuous eye contact with materials during the critical moment of the visual motor task, i.e., at the time a cup handle is slipped over a hook. 2) Generalization of visual attention as defined above. 3) Acquisition of visual motor tasks measured in terms of a) duration of time required for successful task performance, and b) correct completion of task. Sample tasks and critical moments for M.E. are presented below.

S_1: M.E.	Critical Moment
1.) hang cup on hook	--while slipping handle over hook
2.) insert puzzle piece	--from time of positioning over hole to completing insertion
3.) stack glasses	--from time glasses touch rim of other glass (or is centrally positioned) to completing insertion
4.) stack rings on pole	--from time ring touches pole (or is centrally positioned) to complete stacking
5.) put lid on pot	--from time lid touches rim of pot (or is centrally positioned) to completing insertion
6.) insert coin in piggy bank	--from time coin is within 1" of slot to completion of insertion

For M.L., the task involved fixating upon and reaching for objects at desk level, eye level, and above eye level.

The independent variable was use of a continuous correction procedure to establish visual attention before the student was allowed to complete the fine motor task (M.E.), or to reach for the desired object (M.L.).

Design: A multiple baseline across students (Hersen and Barlow, 1977) combined with a multiple baseline/multiple probe (Horner and Baer, 1978) design across six motor tasks within each student was used. Each motor task involved two baseline phases as described below.

Experimental Phases:

Pre-test Baseline: This phase was identical to the instructional baseline phase except that no error correction procedure was used, and reinforcement was delivered on a non-contingent basis.

Instructional Baseline: During this phase, a standard operant instructional procedure was used to teach the skill; however there were no procedures used to establish visual attention to the task. Instruction was as follows:

1.) S^D = Model motor response and hand object to student with verbal cue, "Look and do (x)".

2.) Wait 30" for response completion (measure duration and accuracy of task, visual attention to critical moment.)

3.) If response completion is correct, reinforce with tangible. If response completion is incorrect, fully put S through task without requiring visual attention. Repeat S^D.

4.) If second response is correct, reinforce socially, but do not score as correct trial. If response is incorrect, no consequence. No measurement on any dependent measures.

The instructional baseline phase was included as a control for the possibility that simply teaching a task directly would result in visual attention to the task, rather than needing to develop specific instructional strategies for visual attention.

Visual Attention Training: During this phase, a continuous correction procedure was used to establish visual attention. This procedure involved repeating the cue and necessary prompt to establish looking as many times as needed until visual attention occurred. The critical feature of the procedure, however, was that the prompt be repeated until visual attention was established. Until it was established, the student was not allowed to complete the visual motor task. Procedures were as follows:

1.) S^D = Model motor response and hand object to student with verbal cue, "Look and Do (x)".

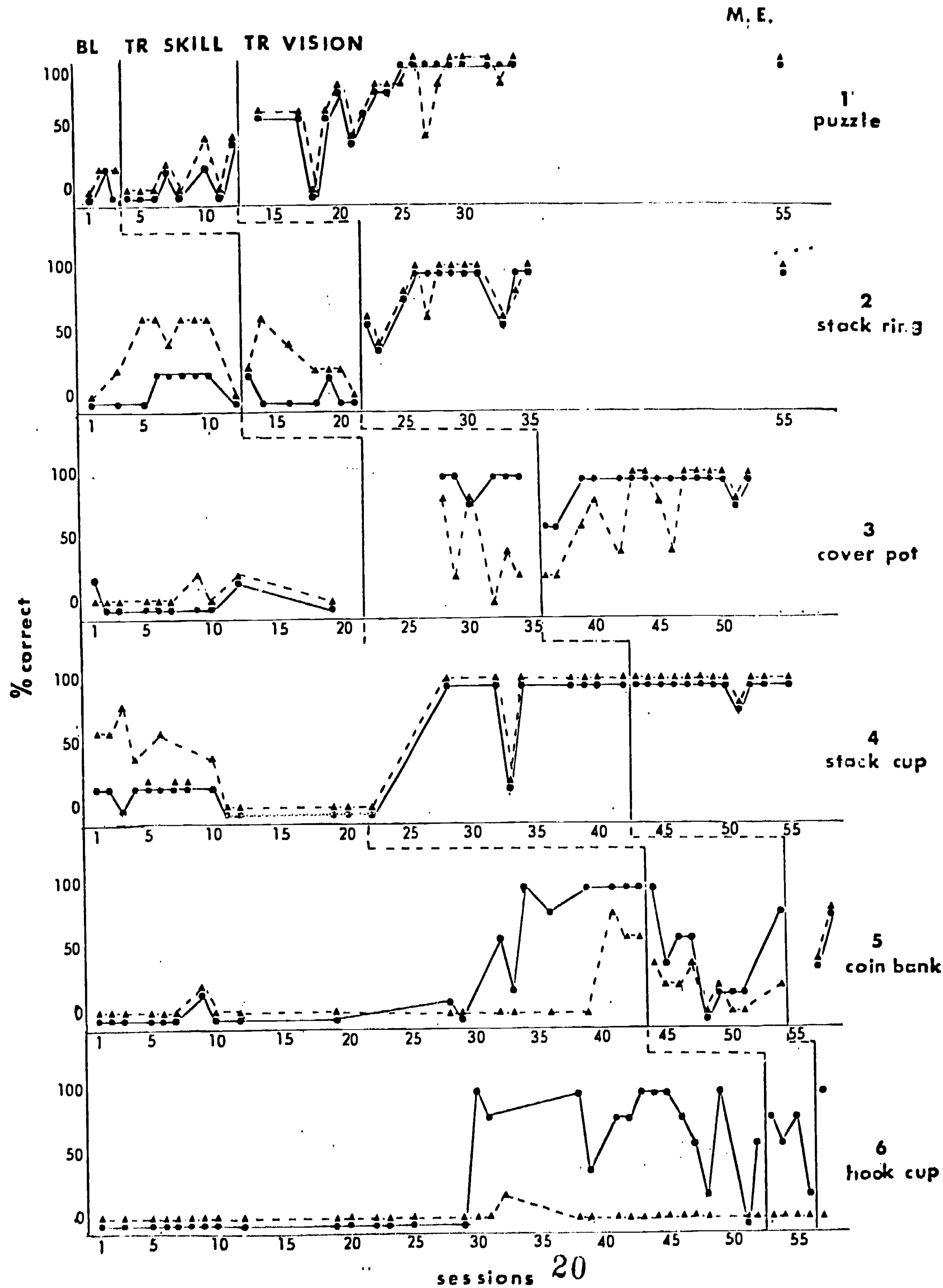
2.) Measure visual attention during critical phase. If visually attending, wait up to 30" and allow task completion. Measure duration and accuracy. If accurate task response, reinforce with tangible. If inaccurate task response, use full put through without requiring visual attention. Repeat S^D and consequate as in instructional baseline phase.

3.) If S is not visually attending, use vision correction procedure to establish attention. Measure duration and accuracy of task. If response is wrong, use put through correction with no intervention on vision. Repeat S^D, establish vision again, and consequate as above. If response is correct, consequate with tangible.

Reliability: Reliability checks were taken throughout on all dependent variables using the formula (#agree/#agree + # disagree). Mean reliability was .97 for M.E. and .94 for M.L.

Results: Figure 3 presents M.E.'s performance data for looking while performing the motor tasks and performance data for accuracy of the fine motor

Figure 3



M. E.
BL
TR SKILL
TR VISION
1 puzzle
2 stack ring
3 cover pot
4 stack cup
5 coin bank
6 hook cup
% correct
sessions

tasks. The initial baseline data for looking while doing indicates that the student failed to look while attempting to do any of the tasks. For the first two skills (complete puzzle and stack ring) skill training alone also did not affect looking behavior. However, the success of the continuous correction procedure in establishing visual attending is reflected in the clear rise in looking behavior each time the continuous correction procedure was introduced.

These data also suggest that once visual attending was established on the first two exemplars, (Session 25) generalized visual attending occurred on the remaining tasks. Both skill three (cover pot) and skill four (stack cups) show an abrupt rise in looking behavior as of session 25, and further generalization occurs gradually and successively on skills five (coin in bank) and six (cup on hook).

On the basis of the looking data alone, it appears that for 4 of the 6 skills (1, 2, 5, and 6) the continuous correction procedure was successful in establishing visual attention, and for two of the skills (3 and 4) generalized visual attention precluded the need for further visual attention training.

The data in Figure 3 also suggest clear covariance between visual attention and accurate skill performance and these data are discussed in further detail in Goetz, Gee and Sailor (Note 1). Data from M.L., which replicate the current findings are also discussed in Goetz at.al.'s forthcoming research report. It is evident, however, that the correction procedure first reported by former project director B. Utley in the 1979 progress report is a potentially powerful and effective strategy for establishing generalized visual attention in this population.

The project thus provided experimental validation of a major innovative educational practice and this correction procedure constitutes a major curriculum strategy in the instructional programming section of the Vision Manual. Furthermore, these data also support the general use of an operant approach in teaching sensory behaviors (cf. Craig and Holland, 1970; Maier and Hogg, 1974; Scheuerman, Baumgart, Sipsma, and Brown, 1976) as discussed in Section 1.

Individual Functional Curriculum Sequencing. Use of an ICS (Holvoet, et al, 1980) curricular model to teach IEP objectives constitutes a second innovative educational practice. Since at least 75% of all IEP objectives in the classroom were taught using an ICS format, the 77% success rate reported for overall IEP acquisition reflects the successful use of ICS as a system of instructional delivery.

The process of developing individual sequences is described in detail in Chapter V of the Auditory Manual. The project tried several times to obtain internally valid data on the comparative effects of ICS training and more traditional forms of instructional delivery (see May 1980 and January 1981 progress reports). These single case studies were not completed due to the relatively short duration of time that individual subjects spent in the project classroom, which precluded completing a full reversal or multiple baseline design. However, empirical support for the use of individual curriculum sequencing is found in several sources. Research on the effects of massed, distributed and spaced practice has been reviewed in detail by Mulligan, Guess, Holvoet, and Brown (1980), who conclude that although much of the available data have been obtained using nonhandicapped learners, in general some form of spaced or distributed practice appears to produce superior learning when compared to massed practice. Numerous other investigators working with severely handicapped students have also reported favorable effects of varying instructional trials and/or distributing practice trials, including superior generalization of motor and discrimination tasks (Panyon and Hall, 1978), generalization of trained expressive signing skills (Gee and Sailor, Ref. Note 2), and acquisition of receptive speech discrimination and labeling skills (Dunlap and Koegel, 1980; Goetz, Ref. Note 3).

In addition to support from these studies, use of functional individual curriculum sequencing as an instructional delivery system for auditory and/or vision objectives is also supported on logical grounds. Auditory stimuli or visual stimuli rarely occur in isolation. In the natural environment, an auditory stimulus occurs and some functional event is the result. Rarely do we turn our head to a speech cue five times in a row in order to be told, "Good, you turned your head." Rather, we localize to a speech source and some functional event follows: we engage in a conversation, receive an object, avoid a dangerous obstacle, etc. Similarly, we orient to an object visually, and some functional event follows: we are able to engage in a fine motor action with the object, receive visual information, etc.

Use of an individual curriculum sequence format allows the teacher to utilize natural and functional events as an integral part of auditory and visual training: the student asks for his toothbrush in order to use it; he turns to the sound of his name in order to receive a desired object from the speaker; he looks at an object in order to successfully manipulate it, etc.

Based upon the IEP acquisition rate of 77% using an ICS format, and upon the empirical evidence discussed above, the ICS format was considered a major instructional strategy for auditory programming and constitutes a major component of the program section of the auditory manual. In addition, recent experimental data from Mulligan (1981) further documents the effectiveness of the ICS model. Thus, although the project did not gather its own experimental data on ICS, it did successfully implement this format in the classroom and found it to be an effective innovative educational practice.

Operant Stimulus Control and Errorless Learning Programs for Vision and Audition. The project developed two instructional programs to prepare students for formal audiological evaluation (OMR and VRL programs). Both programs utilize a stimulus shift paradigm to establish a reliable response that can be used by an audiologist during a formal test session.

Stimulus shifts involve the transfer of stimulus control from one set of stimuli that control a response to a second set of stimuli that do not initially control behavior (Terrace, 1963; Touchette, 1971). Transferring stimulus control requires that the behavior initially be under stimulus control of a given stimulus. Stimulus control is then shifted to a neutral or non-controlling stimulus by pairing the controlling and non-controlling stimuli. Transfer of control occurs through gradual systematic stimulus change in which irrelevant stimulus components are faded out and/or relevant stimulus components intended to ultimately control the response are faded in (see Goetz, Baldwin, Gee and Sailor, 1981, for discussion).

In both programs, a motor response is first established to a light stimulus. Light and sound are then paired as the discriminative stimulus for the motor response. The light stimulus is then systematically faded in intensity in order to shift the response to the auditory stimulus alone. Thus shift may or may not occur (for example, subsequent audiological assessment may indicate a profound bilateral hearing loss). If stimulus control is successfully transferred to an auditory stimulus, the audiologist now has a response to use in testing. Hopefully, he can now present auditory stimuli of varying frequencies and intensities, and the presence or absence of the response can provide information about what the student is hearing. If stimulus control is not successfully transferred, however, the audiologist can still make use of a reliable response to light as part of formal evaluation procedures.

The program entitled "Teaching an Operant Motor Response" (OMR) teaches a motor response such as reaching for an object or performing a specific fine motor task (e.g., stacking rings) in response to the auditory cue. The program entitled "Visually Reinforced Localization" (VRL) teaches a head turn to the auditory cue. The details of each of these programs, including task analyses and data sheets, are found in Chapter III of the Auditory Manual and are therefore not repeated here.

To validate experimentally these programs, a single case design with replicates was used (Hersen and Barlow, 1976). Demonstrating the internal validity of these programs required demonstrating that the instructional procedures used in these programs are in fact responsible for a student's acquisition of a consistent motor response to a sound cue. The experimental design entails a stimulus reversal in which the presence or absence of the light cue and reinforcement is systematically alternated to demonstrate experimental control of the motor response. (All training conditions followed the task analyses and instructional procedures as described in Chapter 3 of the Auditory Manual.)

Data from the first student participating in the validation of the VRL program are presented in Figure 4. This student was a nonambulatory, nonverbal 3½ year old severely retarded boy with cerebral palsy, strabismus, and undocumented hearing status. During the initial auditory baseline (sessions 1-3), his localization responses to varying sound stimuli (drum, bells, maracas) were at consistently low level. However, only three days of training to the light stimulus were needed to establish a consistent head turn to light. The second auditory baseline (sessions 7-9) again showed few correct localization responses.

The first step of training with a combined light and auditory stimulus (sessions 10-11) resulted in a continued high level of responding, and the following baseline performance again indicates that the response had not yet come under control of the auditory stimulus (sessions 12-14). As the training with the combined stimulus continued and the light was faded, data from the probe trials indicate that the response was transferred to the auditory stimulus in relatively abrupt increments. Once established, the responses to the auditory stimulus remained at a consistently high level (sessions 29-37), showing that stimulus control had been successfully transferred.

Interobserver reliability checks were taken every 2-3 days by having an independent observer observe and score a training session. Reliability coefficients were calculated using the formula (# agree/# agree + # disagree) X 100. The mean reliability score was .98.

Data from a second student participating in the validation of the VRL program are presented in Figure 5. This student was a nonambulatory, nonverbal, severely retarded 4 year old boy with suspected visual field losses.

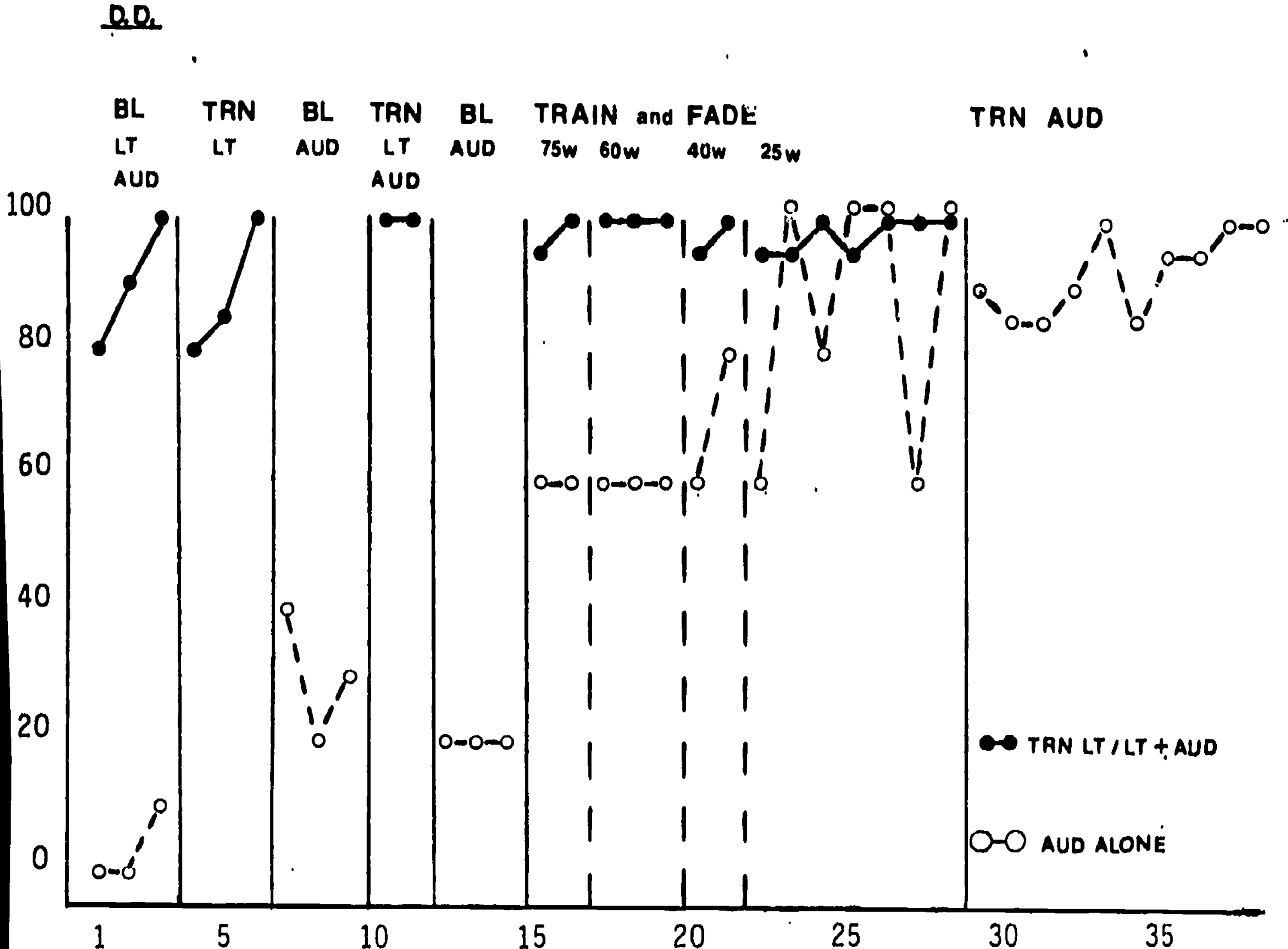

D.D.
BL
LT
AUD
TRN
LT
BL
AUD
TRN
LT
AUD
BL
AUD
TRAIN and FADE
75w
60w
40w
25w
TRN AUD
100
80
60
40
20
0
1
5
10
15
20
25
30
35
TRN LT / LT + AUD
AUD ALONE

Figure 4

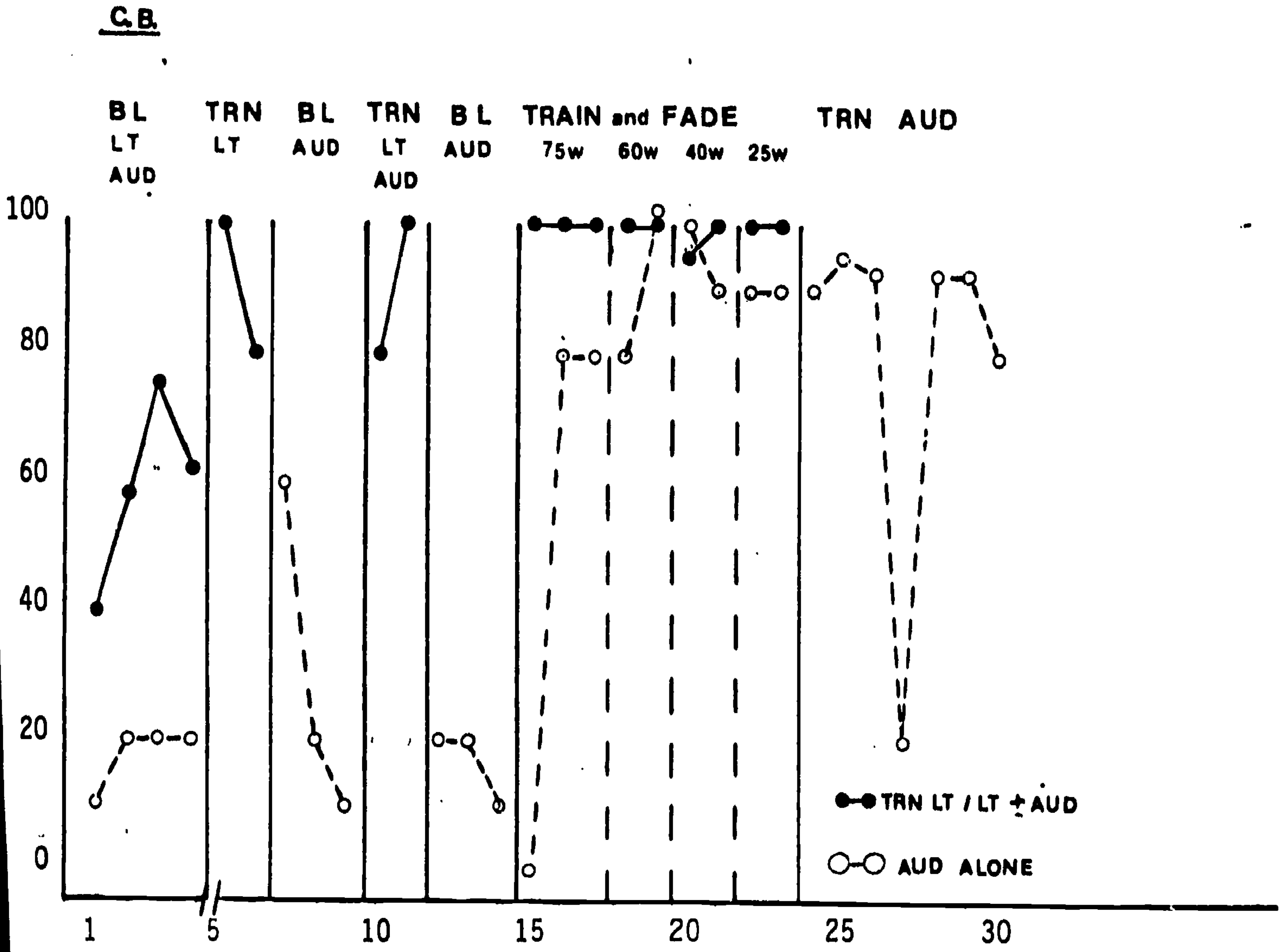

C.B.
BL LT AUD
TRN LT
BL AUD
TRN LT AUD
BL AUD
TRAIN and FADE
75w
60w
40w
25w
TRN AUD
100
80
60
40
20
0
1
5
10
15
20
25
30
TRN LT / LT ± AUD
AUD ALONE

Figure 5

He had been seen by an audiologist. Although hearing was suspected to be within normal limits on the basis of behavioral observation audiometry, he was untestable by any behavioral procedure.

During the initial baseline sessions, his responses to auditory cues (drum, maraca) were at a consistently low level of 20%. His head turn to the light was also variable during the initial baseline, but only two days of training (sessions 5 and 6) were needed to establish a consistent head turn to the light.

A second auditory baseline (sessions 7-9) showed an initially higher level of responding which then decreased to 10%. After this baseline, training with a paired 75 watt and auditory cue began. Two training days were needed to reach 100% correct responding. A third baseline to auditory cues again remained below 20%, indicating the response had not yet shifted to the auditory cue. As the training with the combined light/auditory stimulus continued and the light was faded in intensity, data from the probe trials indicate an abrupt transfer to the auditory cues as of session 16. Once established, responding to the auditory cue remained at a consistently high level.

Interobserver reliability checks were taken every 2-3 days. Reliability coefficients were calculated using the formula (# agree/#agree + # disagree) X 100. The mean reliability score was 1.00.

The above data demonstrate that the VRL instructional program did in fact result in the acquisition of a motor response to sound. Additional replications of these data configurations and comparable data on the OMR program are being prepared for a forthcoming research report (Goetz, Gee, and Sailor, Note 4; see also Goetz, Gee, Baldwin and Sailor, 1981 for a preliminary report).

In addition to the data discussed above, a check on the validity of the VRL/OMR program is whether or not the program discriminates between hearing (defined here as no greater than a 60 db loss) and low hearing (defined here as a 70 db or greater loss) students. To obtain this information, the student's performance on the final program step (motor response to auditory stimulus alone) was compared with the results of formal assessment by a pediatric audiologist within 6 months of program completion for all students who participated in the program, either in the classroom or as part of the validation effort. Those students who did not transfer stimulus control to the auditory stimulus would be expected to have at least a moderately severe hearing loss, while those students who did transfer stimulus control are predicted to have no more than a moderate loss.

Six students have completed the VRL program under direct instruction of project personnel. M.L. was a nonverbal severely retarded 8 year old girl with Down Syndrome and cerebral palsy. She was a nonambulatory student with congenital cataracts that had been surgically removed. A hearing loss was suspected but not documented. M.E. was a 3 year old severely retarded girl who was hypotonic and nonambulatory, and who also had bilateral cataracts that had been surgically removed. A mild loss was suspected but hearing thresholds had not been obtained. H.M. was a nonverbal 4 year old severely retarded boy who was nonambulatory and whose vision was limited to gross light perception. D.D. was a nonambulatory 5 year old boy whose hearing status was questionable but undocumented. He was a severely retarded, nonverbal student whose formal vision evaluation indicated decreased acuity and poor fixation in both eyes. C.B. was a nonambulatory, nonverbal, severely retarded 4 year old with suspected visual field deficits. J.A. was an ambulatory adolescent young man with no visual handicaps. He lacked a vocal communication system and was entering his first school placement at age 13.

Table 5 below indicates each student's time spent in training on the VRL program, the student's performance on auditory probes and during the final program phase, and the results of formal audiological evaluation for the student within six months of program implementation.

Table 6 provides information from students who have completed the OMR program under direct instruction of project personnel. J.D. was a 13 year old severely retarded adolescent boy. He was ambulatory, nonverbal, and had advanced optic atrophy in both eyes. A hearing loss was suspected as he failed to respond consistently to any auditory stumuli. M.R. was a profoundly deaf, retarded 4 year old boy whose etiology included cytomegalic inclusion virus. Glasses had been prescribed for myopia. C.O. was a 16 year old ambulatory deaf-blind girl whose etiology included maternal rubella. M.M. was a moderately retarded ambulatory 6 year old boy with numerous visual disorders and a suspected but undocumented conductive hearing loss. C.V. was a 10 year old severely retarded, nonverbal, ambulatory boy whose responses to auditory stimuli were variable. No visual disabilities were documented. P.G. was an ambulatory, nonvocal adolescent boy with no vision handicaps. T.N. was an ambulatory, severely retarded girl with documented low vision and unknown hearing status. P.K. was an ambulatory, severely retarded nonverbal girl who lacked any communication system and whose hearing status was undocumented.

Table 6 below indicates the time each of these students spent in train-

CONCURRENT VALIDITY: VRL PROGRAM

Student	Total Training Sessions	Probe Performance	Final Step Auditory Cue Alone	Formal Audiological Assessment
M.L.	41	gradual steady acquisition	90% correct responses or better for 2 out of 3 days	mild loss, slightly better hearing in right ear
M.E.	28	gradual steady acquisition	100% correct responses or better for 4 consecutive days	mild loss, normal acqity in at least one ear
H.M.	in progress	less than 20% to date	in progress	profound bilateral sensorineural loss
D.D.	30	abrupt acquisition	100% correct responses for 3 out of 4 days	mild loss, possibly no loss
C.B.	30	abrupt acquisition	90% correct responses for 2 out of 3 days	no loss
J.A.	20	abrupt acquisition	100% correct response, 3 second time delay	in progress

Table 5

CONCURRENT VALIDITY: OMR PROGRAM

Student	Total Training Sessions	Probe Performance	Final Step Auditory Cue Alone	Formal Audiological Assessment
J.D.	76	steady acquisition	90% or better, 2 out of 3 days	mild to moderate loss
M.M.	23	abrupt acquisition	100%, 2 out of 3 days	mild conductive loss
M.R.	58	0% throughout training	0%, 2 out of 3 days	profound bilateral sensorineural loss
C.O.	65	fluctuating, 0% on majority of fading steps	not completed	profound bilateral sensorineural loss
C.V.	62	steady acquition, abrupt loss and recovery	90% or better, 2 out of 3 days	no loss
P.G.	30	abrupt acquisition	90% or better, 2 out of 3 days	in progress
T.N.	in progress			
P.K.	in progress			

Table 6

ing, the student's performance on the auditory probes and during the final program phase, and the results of formal audiological evaluation for the student within six months of program implementation.

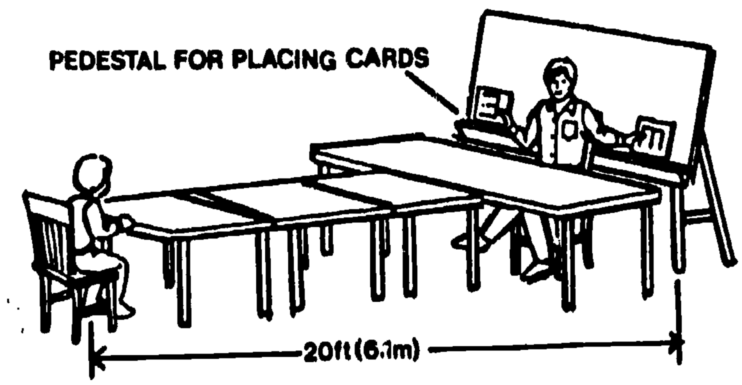
The information in tables 5 and 6 suggests, then, that these programs do differentiate between students with less than a 70 db loss and students with more than a 70 db loss.

In summary, the number of students who have completed (or are near completion) of these programs under direct instruction from project personnel is 14. While N=14 does not appear to be a large number in terms of traditional large N validation efforts, it is important to note that the population for whom these procedures were developed is a comparatively small one (cf. Snell, 1978). In addition, the severely multiply handicapped population is characterized by exterme heterogeneity in terms of specific disabilities and functioning levels (cf. Brown and York, 1974). Thus, if an intervention is successful across several students, despite marked individual differences in cognitive, linguistic, and motor functioning, the implication is that the intervention is a powerful one.

A second factor supporting the appropriateness and predicted success of the procedure for other students is the considerable experimental literature documenting the effectiveness of fading and transfer of stumulus control as an instructional strategy for this population (see Goetz, Baldwin, Gee, and Sailor, 1981, for review). The major variable of concern in these programs, use of a systematic fading strategy to transfer stimulus control, has been repeatedly demonstrated to be an effective one with severely retarded learners.

Taken together these factors greatly increase the confidence with which these programs can be recommended as appropriate and successful curricula for severely handicapped deaf-blind students. The data discussed here validate the innovative educational practice of using crossmodal transfer of stimulus control to prepare students for formal audiological assessment. In addition, they provide strong empirical support for the programs presented in Chapter III of the Auditory Manual.

A second innovative practice using stimulus control instructional procedures was the development of an instructional program for measuring far point visual acuity in this population. This program was based on the work of Newsom and Simon (1977). The goal of the program is to teach the student always to choose a downward pointing Snellen E in a two choice discrimination paradigm. The size of the E's in the choice paradigm is then gradually reduced in accord with specific acuity ratios. The instructional setting is shown in the illustration below.



The initial step of the program requires a discrimination between a downward pointing E and a blank card. The leftward pointing E is then faded onto the blank card along the dimension of orientation, so that the leftward E "grows" in 1 cm increments from a single vertical stripe to a full leftward E in a series of 16 cards. Differential reinforcement is used to establish initial responding to the downward E. Each time the student responds correctly, the leftward pointing E increases by a 1 cm increment. At the end of the training phase, the student thus has learned consistently to choose a downward oriented E when presented with a downward and leftward E of the same size.

Once this discrimination is established, the size of the E's is systematically reduced in accord with acuity ratios. When the student fails to respond consistently according to specific program criteria, his acuity ratio is determined. The details of this program are found in Section V of the Vision Manual.

Figures 6 and 7 present performance data from one of the project students who completed this program. M.R. was a severely retarded, profoundly deaf 5 year old boy. Twenty five sessions were needed for him to complete the program, as shown in Figure 6. Data from testing sessions shown in Figure 7 indicate consistent correct responding at 20/70 level, with incon-

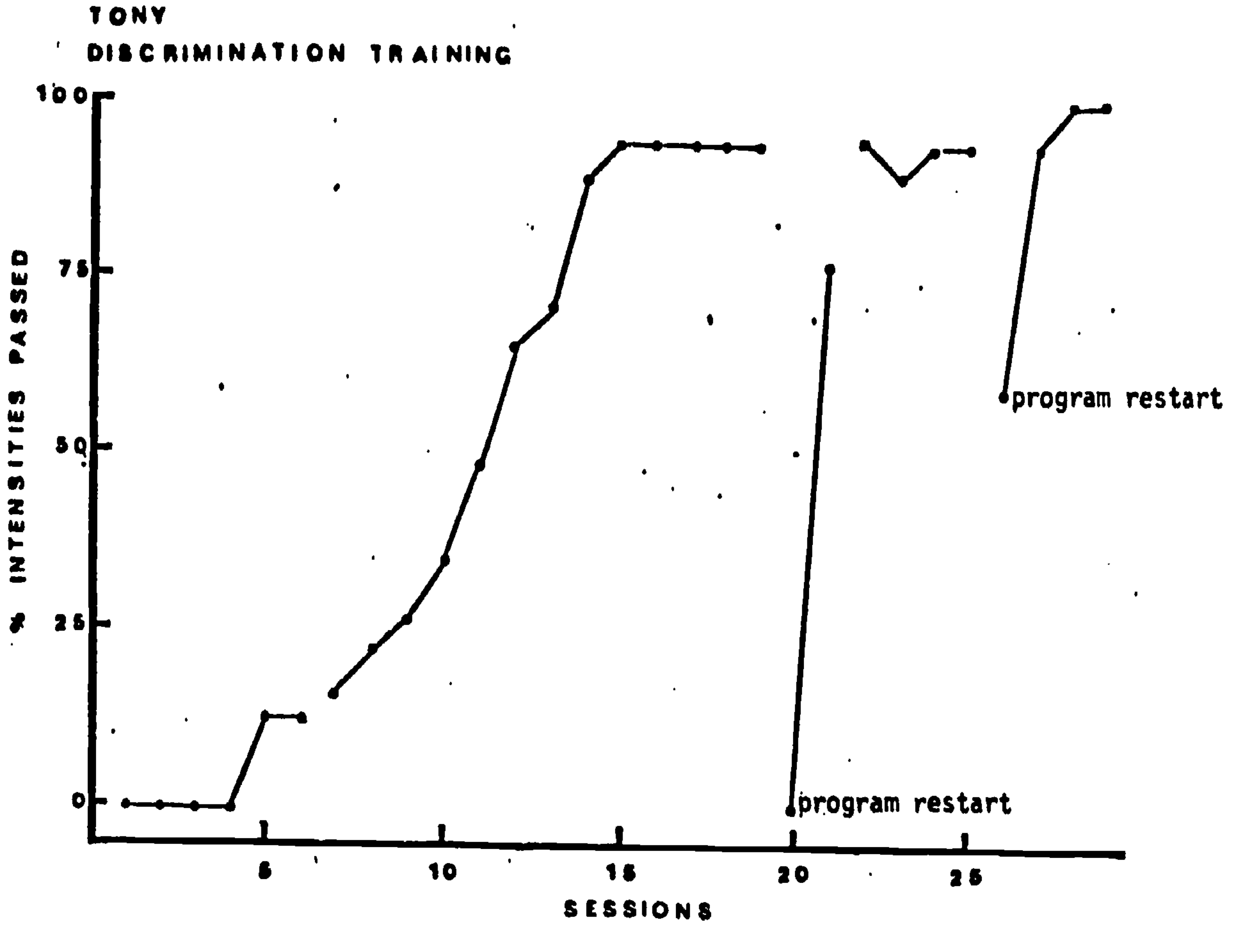


FIGURE 6

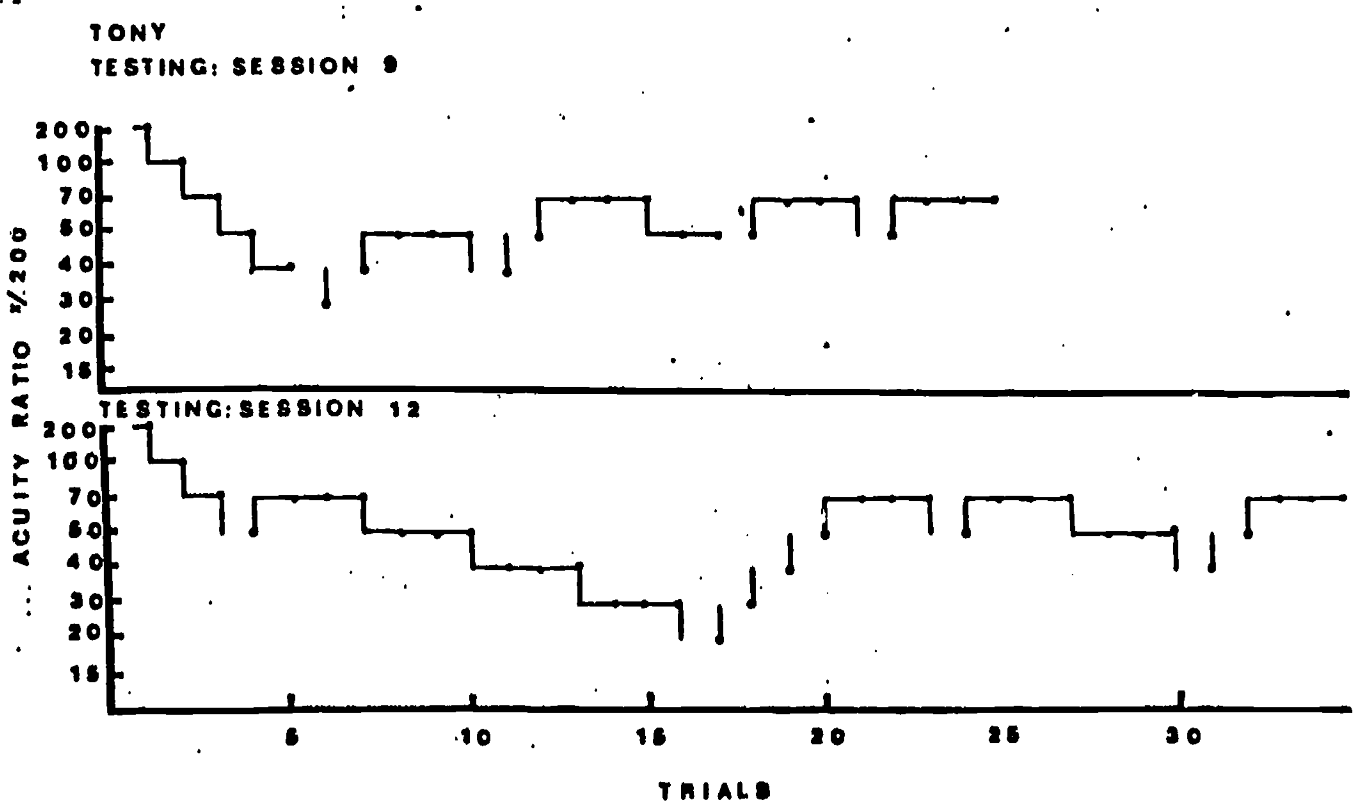


FIGURE 7

sistent responding at the lower 20/50 level.

A total of five severely multiply handicapped students completed this program. Training time ranged from 3 to 35 sessions, but all students were able to acquire the discrimination and complete the testing. This procedure therefore appears extremely effective and forms the basis of Section V of the Vision Manual. As with the OMR and VRL programs, these outcomes also validate the use of operant teaching strategies applied to the content areas of sensory functioning.

Expressive manual signing curriculum. This curriculum task analysis was developed by Kathleen Gee, the project teacher, and divides expressive signing into 3 components: position, configuration, and movement. The complete program is found in Table 7.

To demonstrate that this program does in fact result in acquisition of expressive signs, one project student was taught three signs in a multiple baseline design across responses using this instructional program. This student was a severely retarded, profoundly deaf student with variable esotropia. His performance data are presented in Figure 8. Although no reliability data were taken, these data strongly indicate that this program was in fact responsible for the student's acquisition of the signs. Each time training was introduced after baseline phases, the student rapidly acquired the initial training step and continued to acquire training steps throughout instruction.

A total of 5 project students were instructed in expressive signing using this program. The total number of signs mastered was 19, or an average of 4 signs per student during a 6-9 month classroom placement. These data validate the effectiveness of this innovative educational practice.

Evaluation and Recommendations. All innovative educational practices, with the exception of the ICS model, were validated directly by the project using single case time series designs with replications. All of these procedures can be recommended for use with members of this population whose specific needs are met by the procedures (e.g., students requiring audiological evaluation, students for whom signing has been selected as a communication mode, etc.). All of these procedures were also task-analytic, data based, and operant in nature and validation of their effectiveness lends additional support to the noncategorical classroom model developed by the project.

EXPRESSIVE LABELING

Behavioral objective: When presented with an object/person and the consecutively spoken and signed cue: "What's this?/"Who's this?" the student will sign the label for the word correctly 80% of the specified trials for two out of three days.

Materials: Clipboard and data sheet, designated objects for each student.

General procedures: The signs are taught as a part of other instructional sequences so the data is spread out over several programs. Whenever a sign is being taught there is a place on the data sheet for designating which step of the following task analysis the student is working on. The signs are taught in three basic parts: (A) the position--the placing of the hands relative to the body; (B) the configuration--the actual form the hand(s) must be in; and (C) the movement--the designated motion the hands must make while remaining in the configuration. Each of these parts of the sign is taught by a series of physically putting through, prompting, and modeling to the extent designated by the step in the task analysis.

For some signs it may be more desireable to start with learning the movement, whereas for others the configuration may be taught first. Therefore, the three parts have been listed as A, B, and C in the task analysis, but may be taught in any order depending on the decisions made from pretest and continuing data. The steps for each part should remain in the order written unless a decision is made to change.

Depending on the sign the number of motions will vary. The entire movement is taught in part A, but the movement may be only a one-direction motion or consist of two or more motions. For purposes of consistency, each motion is a one-directional part of the movement and is taught separately. For example, the movement of the sign for "food" consists of only one motion (bringing the hand to the mouth), but the movement for the sign for "music" consists of two motions (rubbing the "m" hand on the forearm going towards the body and then away). Some signs may require the

Table 7

(general procedures)
repetition of a movement. Steps 3 and 4 of part A provide for two motions (either a different motion or a repetition of the first). See notes for each sign as to whether steps 3 and 4 are necessary and if further steps under part A are required.

Part D is always the final part of the program.

For each step present the object (or person) and say and sign, "What's this?" ("Who's this?"). The spoken and signed cue should be given consecutively at all times--say the cue, then sign it. Continue to teach as specified on the following steps.

Correct response: The student must correctly perform the action exactly as specified on the first trial, within approximately five seconds of the cue, to be reinforced and marked (+).

Incorrect response: If the student responds incorrectly, does not respond at all, or only partially responds, mark (-) and then put the student through the correct response, repeat the cues again and wait for a response. Continue to repeat the correction procedure until a correct response is elicited. Then record the number of trials with prompts it took before the correct response was performed next to the (-) score.

Data: Record percent correct out of designated trials. Record average number of correction trials per trial.

PART A: MOVEMENT

TEACHER	STUDENT
1.a. Present the object. Say and sign, "What's this?" Completely prime the student through the position, configuration, and movement of the sign. Return the student's hand(s) to the point at which the final portion of the movement is to be made. Tap the student's hand to complete the movement.	1.a. Hands remain in configuration and complete the sign by finishing the movement.
b. Present the object. Say and sign, "What's this?" Completely prime the student through the position, configuration, and movement of the sign. Return the student's hand(s) to the final portion of the movement to be made.	b. Hands remain in configuration and complete the movement.
2.a. Present the object. Say and sign, "What's this?" Completely prime the student through the position, configuration, and movement of the sign. Return the student's hand(s) to the point at which he must make the entire last movement. (It may be the only movement.) Prompt by tapping his hand to begin.	2.a. Student performs entire last movement of the sign following hand tap by instructor.
b. Present the object. Say and sign, "What's this?" Completely prime the student through the position, configuration, and movement of the sign. Return the student's hand(s) to the point at which the final (or only) motion is to be made.	b. Completes the sign by performing the entire final (or only) motion.
c. Present object. Say and sign, "What's this?" Prime student to perform the position, configuration, and the movement to the point of the final motion. If there is only one motion prime only the position and configuration. Release.	c. Completes the sign by performing the final (or only) motion without any prior prime of the motion.

Table 7

Part A: movement, continued

TEACHER	STUDENT
(Use if necessary when the movement of the sign has 2 motions.)	
3.a. Present object. Say and sign, "What's this?" Completely prime student through the position, configuration, and first motion of the movement. Then return student to the point at which the final portion of the first motion is to be made. Prompt to continue by tapping hand.	3.a. Completes sign movement by finishing first motion and performing final motion.
b. Present object. Say and sign "What's this?" Completely prime the student through the position, configuration, and first motion of the movement. Then return student to the point at which the final portion of the first motion is to be made. Prompt to continue by tapping hand.	b. Student completes sign movement by finishing the first motion and performing the final motion.
4.a. Present object. Say and sign, "What's this?" Completely prime the student through the position, configuration, and first motion of the movement. Return student to point of first motion and prompt to begin by tapping hand.	4.a. Completes movement by performing first motion following prompt and performing final motion.
b. Present object. Say and sign, "What's this?" Completely prime student through the position, configuration, and first motion of the movement. Return student to point of first motion.	b. Completes movement by performing first motion and last motion.
c. Present object. Say and sign, "What's this?" Completely prime student through the position and configuration of the sign only.	c. Completes movement by performing first and last motions.

PART B: CONFIGURATION

TEACHER	STUDENT
1.a. Present the object. Say and sign, "What's this?" Prime the student to form the position of the sign and the configuration. Return the student's hands to a non-configuration state and prompt student to form configuration by partially putting fingers in place. Release. Following a correct response, if the movement has not been learned yet, prime student through movement.	1.a. Student must complete the form of the configuration following prompt. (Then perform movement if already learned.)
b. Present the object. Say and sign "What's this?" Prime the student to form the position and configuration. Return students' hands to a non-configuration state and release. Following correct response, if movement has not been learned, prime student through movement.	b. Student must perform the configuration independently. (Then perform the movement if already learned.)
1.c. Present object. Say and sign, "What's this?" Model correct response. Prime student to form position only. Release. If the student has not learned the movement yet, then prime to complete movement.	1.c. Performs configuration independently. Performs movement if already learned.

PART C: POSITION

TEACHER	STUDENT
1.a. Present object. Say and sign "What's this?" Model correct response. Prime student to put hands in correct position for sign. Release and return hands to rest position partially moving hands to begin. Release. Following response, if not yet learned, prime student through configuration and/or movement.	1.a. Completes formation of correct position. If already learned, performs configuration and movement.

Table 7

Part C: position, continued

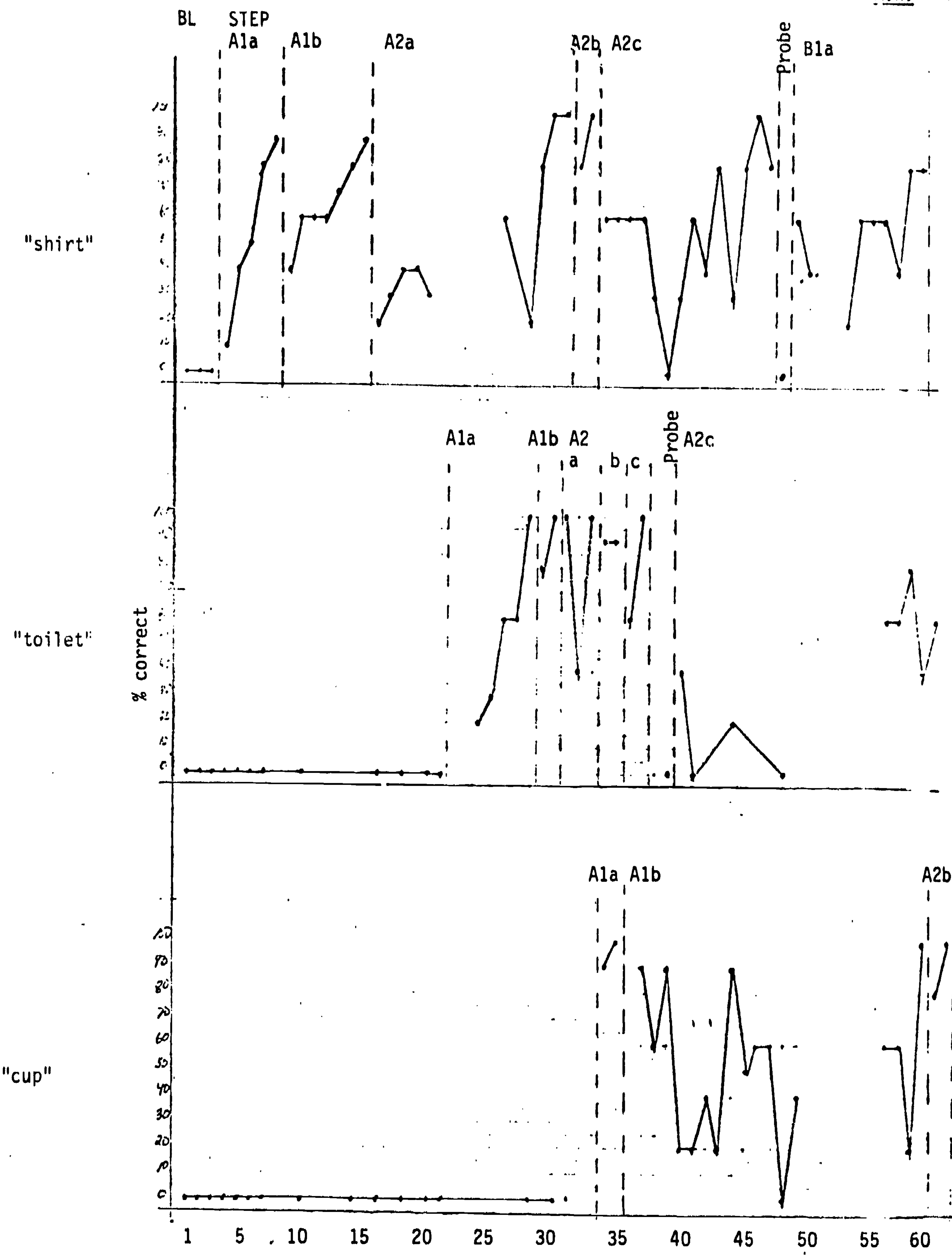
TEACHER	STUDENT
b. Present object. Say and sign, "What's this?" Model correct response. Prime student to put hands in correct position and return hands to rest. Following correct response, if configuration and movement are not yet learned, prime student through both.	b. Forms correct position. If configuration and movement already learned, performs them.
c. Present object. Say and sign, "What's this?" Model entire correct response. Student must put hands in correct position. Following correct response, if configuration and/or movement not yet learned, prime student through.	c. Forms correct position for sign. If already learned, performs configuration and movement.

Note: If the student has completed Part C to criterion, step D.1. is not necessary.

PART D: SIGNING WITH NO PRIME OR PROMPT

1. Present object. Say and sign, "What's this?" Model correct response.	1. Student imitates correct response.
2. Present object. Say and sign, "What's this?"	2. Student correctly signs.

Table 7


BL
STEP
A1a
A1b
A2a
A2b
A2c
Probe
B1a
"shirt"
A1a
A1b
A2
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Probe
A2c
"toilet"
% correct
A1a
A1b
A2b
"cup"
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EXPRESSIVE SIGNING

Figure 8

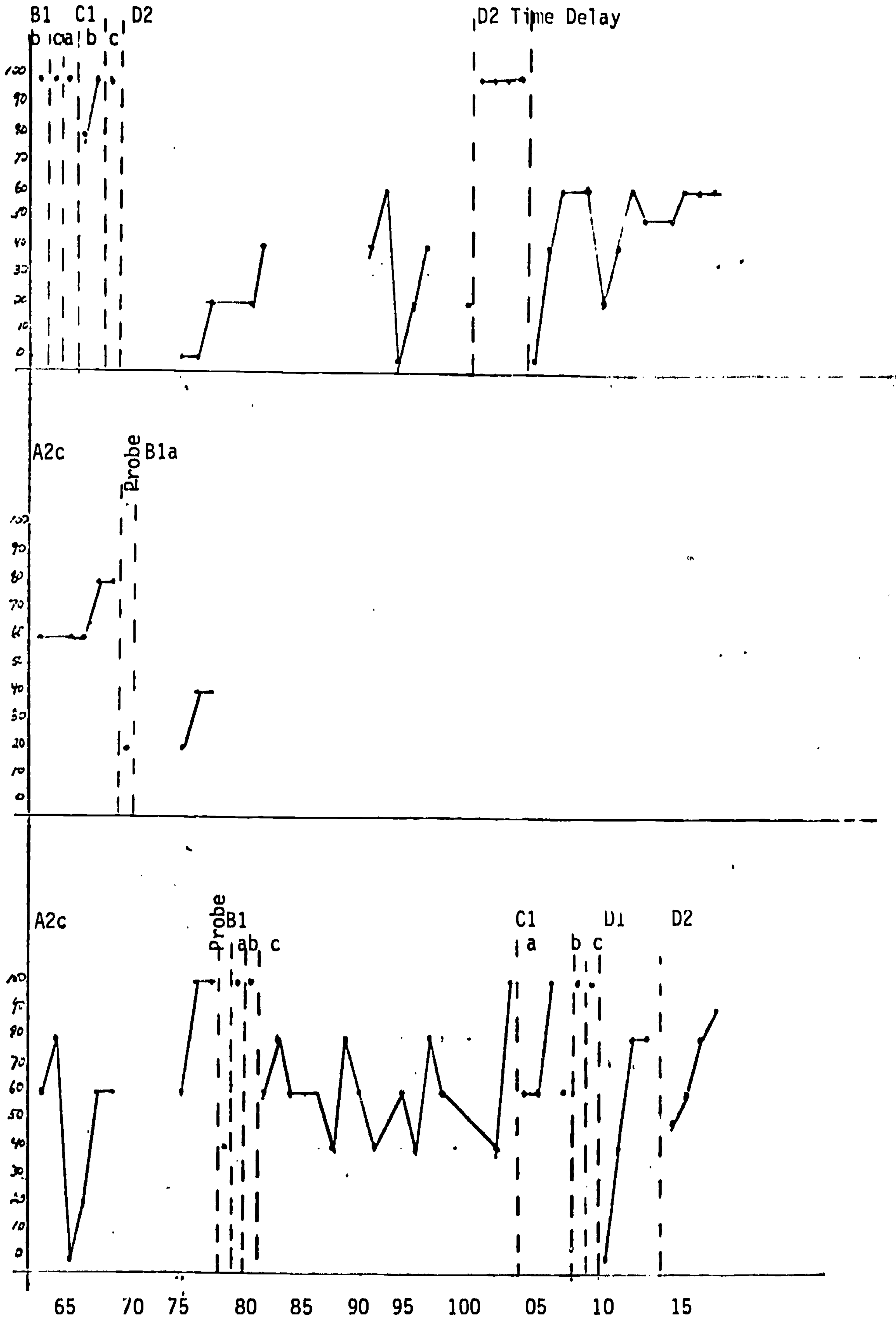

B1
b ca a b c
C1
D2
D2 Time Delay
100
90
80
70
60
50
40
30
20
10
0
A2c
Probe
B1a
A2c
Probe
B1
ab c
C1
a
b c
D1
D2
65
70
75
80
85
90
95
100
05
10
15

Figure 8

3) PRODUCTS: ASSESSMENT AND PROGRAM MANUALS FOR HEARING AND VISION

Auditory Manual. The auditory manual is included as Appendix A. (This is the working draft copy; the published copy will be sent under separate cover.)

Evaluation. Classroom development data (interobserver reliability) is reported in detail in Appendix A of the manual and is not repeated here. Development data for the major curricular programs (OMR and VRL) is discussed in detail under Section 2 above.

In addition to development data on instructional programs, Dr. Robert Sweetow, director of the San Francisco Hearing and Speech Center, provided technical editing of the manual. Victor Baldwin, Ph.D., and Barbara Wilcox, Ph.D. provided field readings and relevant feedback was incorporated into the final edition.

In Spring, 1981, a revised edition of the manual, complete with the exception of Chapter V, was field tested with a small sample of severely handicapped and deaf blind teachers in Southern California and the Bay Area. Teachers were solicited through a Deaf-Blind Regional Center conference. Those who agreed to participate were sent the manual and asked to implement the manuals in their classrooms. Project personnel then visited these teachers in their classrooms and filled out the checklist found in Table 8.

The small sample of teachers who completed all of the field test activities made statistical evaluation impractical. However, based on the detailed narrative data obtained from Table 8 on a sample of 8 teachers, specific narrative changes were made to clarify procedures in Chapters II and III. Furthermore, project staff assigned a summary score of whether the teacher appropriately implemented the manual procedures based on exposure to the manual alone (i.e., in the absence of any workshop training or direct feedback). Based upon this rating, 50% of the field test teachers were able to follow the directions for setting up the OMR/VRL programs in their classrooms.

As a final form of evaluation of the manual, consumer satisfaction data from the project's training workshops are available. These workshops provided hands on practice implementing and using the contents of the Auditory Manual (see Section 4 below). Workshop attendees were asked to rate the information presented on a 0-5 scale in terms of relevance to their classroom needs. Of 231 respondents, the average rating for classroom relevance was 4.3, suggesting that teachers found this information directly pertinent to their students.

VALIDATION CHECKLIST - AUDITORY MANUAL

I. Informal Auditory Assessment

A. Comments from the teacher prior to observing him/her do the assessment (problems, things which were unclear):

B. Positions of student and teacher for best test results (score + or - and comment):

C. Watch 5 trials without scoring the student's response. Score the teacher:

1. + or - and comment:
2. __________
3. __________
4. __________
5. __________

For a correct score (+) the teacher must present the sound stimulus at the appropriate time as directed, keep the sound stimulus on for approximately 10 seconds if needed, wait an appropriate interval between trials, give the cue discreetly to the assistant behind the student, and record data for each trial.

D. Have the teacher do 5 more trials and score the student's responses below. Then fill in the teacher's scores for the student in the second space below.

	R/L	STIM	Eyes	Search	Activity Increase	Activity Decrease	Smile/ Laugh	Frown/ Cry	Vocal	Startle	No Change	Other (Describe)
1												
2												
3												
4												
5												

Teacher

1												
2												
3												
4												
5												

E. Have the teacher total the trials on his/her data sheet. Check the data and comment below on anything that was incorrectly summarized.

Table 8

II. Auditory Programmatic Assessments

A. OMR or VRL (circle one)

B. Comments form the teacher prior to observing him/her do the assessment (problems, things which were unclear):

C. Look at the equipment set-up and placement of teacher and student. Score a + only if the equipment and people involved are set up so that trials can be run accurately. Score + or - and comment: ____

D. Trials: Step:_______

	+ or - and comments	student's score	teacher's student scores
1.			
2.			
3.			
4.			
5.			

E. Look at the teacher's data sheet and score whether it was used correctly: (+ or - and comment):______________________

F. Look at the graph of summarized data of the training trials so far and score + or - and comment:

G. Was this program appropriate for the student according to the decision model? Score + or - and comment:____________________________

Table 8

Taken together, these outcomes suggest that the Auditory Manual can function as a stand alone product and that its contents are applicable to the diversity of students included in the severely handicapped deaf blind population. Furthermore, need for this manual, as expressed by potential users, is high.

Recommendations. The auditory manual developed by this project appears to be a genuine state of the art product. The manual successfully teaches teachers how to prepare difficult to test, multiply handicapped students for comprehensive audiological evaluation through systematic training in the test paradigms used by audiologists. As discussed in detail in Chapter III of the manual, pediatric audiologists have long used conditioning procedures such as play audiometry, TROCA procedures (Fulton, 1974; Lloyd, 1966) and visual reinforcement audiometry (Suzuki and Ogiba, 1961) for testing infants and difficult to test persons. However, audiologists rarely have the time needed successfully to condition responses in severely/profoundly retarded, deaf-blind multihandicapped students. The procedures developed by this project enable classroom teachers to accomplish this initial conditioning, so that the student arrives at the audiologist's office with a reliable response for use in testing. It thus appears that a major assessment need for this population - accurate audiologic assessment - has been successfully addressed.

In terms of future directions for auditory assessment and programming for this population, a major need is the development of reliable procedures for selecting communication modalities once hearing has been assessed (cf. Sailor, Guess, Goetz, Schuler, Utley and Baldwin, 1980). A major and recurring question posed by teachers attending our workshops was how to decide what communication system (e.g., signing, picture books, total communication) to use with students who had multiple sensory handicaps in addition to profound retardation. For example, once a profoundly bilaterally deaf student with low vision has been provided with amplification, should his communication mode be a combination tactile auditory system? Investigation into which factors can help to predict selection of an appropriate communication mode for these students is a pressing need.

Furthermore, teachers in the field also expressed a recurrent need for documented effective teaching procedures for teaching initial alternative communication modes to severely multiply handicapped students, e.g., how can one best establish an eye gaze as a reliable expressive response mode in a severely physically handicapped deaf student? How can a student be taught to use a 3-D tactile system to express communicative needs? The project developed numerous programs for individual students which addressed these questions, but systematic replication and validation of such programs is sorely needed.

Vision Manual. The vision manual is included as Appendix B. This is the final form of the manual as it has been disseminated and will continue to be disseminated.

Evaluation. Classroom development data (interobserver reliability) on Sections I-III was reported in the May 1981 progress report and was uniformly excellent across all assessments. Development data for the acuity measure (Section V) is discussed in detail under Section 2 above. Development data in support of the instructional programming section of the manual (Section VII) are also discussed in detail under Section 2 above (innovative educational practice #1).

In addition to development data on individual assessment procedures, Jan Peterson, research associate at the University of California Medical Center, provided technical editing. Phil Hatlen, Ph.D., Rebecca DuBose, Ph.D., and David Shoch, M.D. (ophthalmology) provided field readings and relevant feedback was incorporated into the final edition.

In Spring, 1981, a revised edition of the manual, complete with the exception of Sections IV and VII was field tested with a small sample of severely handicapped and deaf blind teachers in Southern California and in the Bay Area. Those who agreed to participate were sent the manual and asked to implement the assessments in their classrooms (with the exception of the far point acuity assesment). Project personnel then visited these teachers in their classrooms and filled out the check list found in Table 9.

Statistical evaluation of these data was not undertaken as the sample who completed all the field test activities was small (N-10). However, based on the detailed narrative information available from Table 9, specific narrative changes and changes in illustrations were made in all assessments.

As with the auditory manual, project staff also assigned a summary score of whether the teacher appropriately implemented the assessments based on exposure to the manual alone (i.e., in the absence of any workshop training or direct feedback). Based upon this rating, only 20% of the field test teachers were able to implement the assessments in their classrooms on the basis of the manual alone.

Consumer satisfaction data from attendees at the project's training workshops confirms this field test outcome. 355 attendees gave the vision workshops a mean rating of 4.4 out of 5 for quality and a mean rating of 4.3 for relevance. However, narrative responses indicated that many participants

VALIDATION CHECKLIST - VISION MANUAL

I. Gross Measures of Vision

A. Test observed ____________________

1. Comments from the teacher prior to observing him/her do the assessment (problems, things which were unclear):

2. Positions of student and teacher for best test results (score + or - and comment):

3. Lighting in the room for test (score + or - and comment):

4.

trials	teacher (+ or - and comments)	score student	teacher's student score
1.			
2.			
3.			

II. Do the Eyes Work Together?

A. Test observed ____________________

1. Comments from teacher:

2. Positions of student and teacher:

3. Lighting:

4.

trials	teacher (+ or - and comments)	score student	teacher's student score
1.			
2.			
3.			

B. Test observed ____________________

1. Comments from teacher:

2. Postions of student and teacher:

3. Lighting:

4.

trials	teacher (+ or - and comments)	score student	teacher's student score
1.			
2.			
3.			

Table 9

III. Peripheral Fields

A. One or both eyes____________________

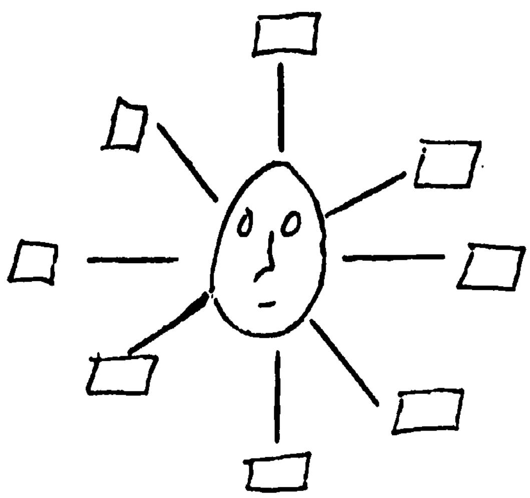
1. Comments from the teacher:

2. Positions of student and teacher:

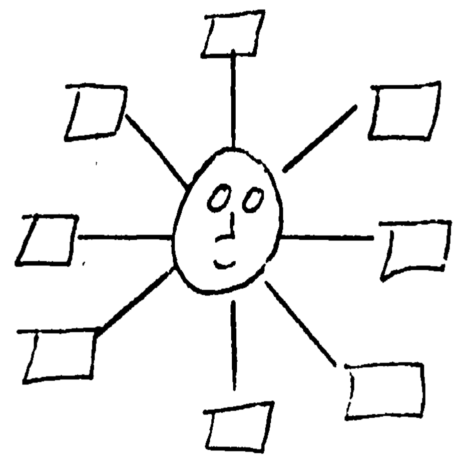
3. Lighting in the room:

4. Trials

Score student



Teacher's scores for student



Score teacher on 3 trials: 1.
2.
3.

felt that the hands-on supervised experience doing actual assessments with children (provided as part of the workshops) was critical to using the assessments in their classrooms (see Section 4 below). Thus, it appears that the vision manual assessments will be most appropriately utilized if teachers are provided with supplementary workshop training.

Recommendations. Numerous vision assessment guides and manuals now exist for multiply handicapped students (cf. Langley, 1980). This manual offers the most comprehensive and thoroughly detailed set of procedures available to classroom teachers. However, it is apparent that if teachers are fully to utilize these assessments, additional training is desirable. A future need in the area of vision assessment is thus the development of high quality media (e.g., video cassettes and/or films) demonstrating these assessments and providing teachers with an opportunity to observe typical and atypical responses to the assessment procedures. A training film to accompany the present manual would greatly enhance its effectiveness.

A second major research need growing out of the present project is further identification of the skill contexts in which visual behavior should be taught. The data presented in Figure 3 (p. 16) show acquisition of generalized visual attending skills as a function of operant instruction. However, these data also suggest a clear covariance between visual attention and skill performance. For example, during skill #6, putting a cup on a hook, generalized visual attention occurred as of session 30. However, this skill was a motorically complex one, and even visually attending to it did not appear to improve skill performance. Thus, when looking was not consequated with successful skill performance, it appears to have undergone extinction beginning at session 45. The skill context in which visual behaviors are taught thus appears to be a critical factor in effective vision programming in the classroom. Further research into this area, and into the nature of stimulus items best selected for use during vision training, would be highly desirable. Such information would have direct impact upon successful vision instruction in the classroom. (Chapter VII of the Vision Manual also provides further discussion of these points.)

4) INSERVICE TRAINING AND WORKSHOPS

Inservice training constituted a significant component of the project. Inservice training, and preservice training and dissemination took several forms.

Intensive Individualized Inservice. In accord with the contract, students remained in the classroom for an interim period only. Students returned to their original classrooms after hearing and vision assessments were accomplished and IEP's had been reformulated. When students returned to their original classrooms, the receiving teacher received from 3-5 days of intensive, individualized inservice from the project teachers. This inservice training included spending 1-2 days in the project classroom working directly with the target student. The project teacher then went with the student to his original classroom for an additional 2-3 days to assist in integrating the student's program into the teacher's classroom day. This process is described in detail in the January, 1981 and May, 1981 progress reports.

A total of 10 teachers received this inservice: 4 severely handicapped teachers at segregated sites, 2 visually handicapped teachers, 1 home teacher, 1 teacher of orthopedically handicapped students, and 1 severely handicapped teacher in an integrated setting. Data were taken on the following measures before and during the inservice training: number of hearing and vision programs, number of programs using functional sequencing, and number of programs with daily data collection. As discussed in the May, 1981 progress report, analysis of these data was by visual inspection of graphed results.

Of the ten teachers, 40% successfully used and generalized project practices as a result of inservice training, while an additional 40% were able at least to use the practices to serve appropriately the student they received from the project. Only two teachers, or 20%, failed to utilize any inservice opportunities to enhance educational programs for their students. In addition, 4 teachers who did not receive project students voluntarily used their own staff development time to spend a day in the project classroom learning innovative project practices. These teachers included a severely handicapped teacher from San Francisco, and a severely handicapped and a visually handicapped teacher from San Mateo, and a severely handicapped teacher from Sacramento.

Training Workshops. Training workshops were offered both to inservice and preservice teachers. Workshops focused either on hearing, vision, or functional sequencing. Each workshop was a full day in length.

The vision workshop used the following format: overview of the assessments, hands-on practice with actual project students in performing assessments 1-5, presentation of the far point acuity program (assessment #6) using videotapes of project students, and a lecture/discussion on vision programming in the classroom. The auditory workshop included the following: discussion of Chapter II, informal assessment, presentation of Chapter III VRL and OMR programs using videotapes of project students, practice sessions using the OMR/VRL equipment, and lecture discussion of functional auditory programming. The workshops on functional sequencing included videotapes of actual programs and small group practice in developing actual sequences. Excerpts from the Vision Manual (Section VI) and the Auditory Manual (Chapter III) were disseminated at all workshops.

The total number of workshops and workshop participants (inservice and preservice) for the 3 years of the project is presented in Table 9. The total number of trainees in this table is 304. (Note that this is not an unduplicated count, as one preservice/inservice group may have participated in 2 or 3 workshops.)

During year 3, two measures of inservice effectiveness of these workshops were taken. One was a pre-post test written evaluation of informational competencies gained through the workshop. The second was a consumer satisfaction questionnaire and rating scale.

The written pre-post measures for the vision and auditory workshops are presented in the January, 1981 progress reports. Both are short answer, fill in the blank tests covering information contained in the workshops. Seven groups were evaluated using these measures. The t test for correlated means was used to test for significance in differences between pre and post test scores for each group. The results are presented in Table 10. All t tests were highly significant.

Consumer satisfaction was evaluated using a rating scale. Participants were asked to rate each major component of the workshop on a scale of 0-5 for relevance to their classroom and 0-5 for quality of the presentation. In addition, several open-ended questions were asked. Table 11 below summarizes the findings of this evaluation and indicates uniform scores between 4.2 and 4.6 on a scale of 0-5 both for quality and relevance of the presentations.

The most frequent spontaneous response of the participants to open-ended questions was that the information presented was valuable and relevant to the classroom. The practice sessions with the children (vision assessment procedures) and the practice sessions with the equipment and training materials (OMR, VRL, and Far Point Acuity) were mentioned as the most positive aspects of the workshop. The videotapes and the emphasis on functional sequencing were also mentioned by some of the participants.

Responses to the question "What would you change about the workshop?" were used to alter various aspects of the presentation. The most frequent

Table 9

	AUDIENCE	N	TOPIC
Year 1:	SFSU Preservice and Inservice	15	Vision Assessment
Year 2:	SFSU VH Preservice	14	Vision Assessment
	SFSU Preservice and Inservice	24	Vision Assessment and Programs
	SFSU Preservice and Inservice	15	Functional Sequencing
	SFSU Preservice and Inservice	15	Auditory Assessment
Year 3:	San Mateo VH Teachers	14	Vision Assessment
	SFSU Preservice	24	Vision Assessment and Programs
	SFSU Preservice and Inservice	24	Auditory Assessment and Programs
	SFSU Preservice	12	Functional Sequencing
	SFSU Preservice	12	Vision Assessment and Programs
	San Jose State Univ. Preservice/Inservice	15	Auditory Assessment and Programs
	SFSU Preservice	12	Auditory Assessment and Programs
	San Jose State Univ. Preservice/Inservice	15	Vision Assessment
	SFSU Preservice	12	Functional Sequencing
	SFSU Preservice	6	Vision Assessment and Programs
	San Jose State Preservice and Inservice	15	Vision Programs
	Marin County DCH Inservice	9	Vision and Auditory Assessment
	SFSU Vision Teachers	15	Vision Assessment and Programs
	Deaf Blind Inservice (multi-counties)	12	Vision and Auditory Assessment
	Bay Area Counties Inservice (voluntary Saturday workshop)	10	Vision and Auditory Assessment
	SFSU Preservice and Audiologists	13	Auditory Assessment
	SFSU Preservice	10	Functional Sequencing
	TOTAL N =	304	

Table 10

Training Workshops - Year 3

	N	$\bar{X}$ pre	$\bar{X}$ post	$\bar{X}$ diff	t value	significance level
Auditory I (3/11)	20	5.1	12	7.15	7.8	$p < .0005$
Auditory II (3/18)	11	7.2	15.2	8.	4.422	$p < .005$
Vision I (RGR Fall '80)	9	5.8	8.8	3.	4.02	$p < .005$
Vision II (3/4/81 W.S.)	12	4.3	8.75	4.4	7.57	$p < .0005$
Vision III (10/23/81) San Mateo Vision teachers Assessment	14	4.2	9.4	5.07	8.25	$p < .0005$
Vision IV (3/25) Sue Winton San Jose State	22	4.3	8.5	4.27	14.25	$p < .0005$
Vision V (3/26) San Mateo Vision Resource Teachers	11	2.9	9.1	6.9	4.05	$p < .005$

Table 11

Workshop Component	N	$\bar{X}$ Quality	N	$\bar{X}$ Relevance
Vision:				
Overall evaluation	129	4.6	115	4.4
Discussion of purpose of each assessment	65	4.6	63	4.3
Assessment procedures	68	4.5	60	4.4
Hands-on practice with children	57	4.5	54	4.2
Acuity assessment	86	4.4	80	4.3
Auditory:				
Basic principles	34	4.6	32	4.4
Informal assessment	52	4.6	49	4.4
OMR presentation	45	4.4	43	4.1
VRL presentation	66	4.6	62	4.3
Practice w/equipment	30	4.5	28	4.5
Format:				
Videotapes	114	4.3	80	4.2
Overheads	117	4.2	76	4.2
Handouts	123	4.4	93	4.6

responses to this question usually concerned the issue of time and quantity of information presented. It was generally felt that too much information was given out in too short a time.

Participants were also asked if they would use some part of the information presented in their classroom. Virtually all of the participants who responded to this question desired to use some part of the information presented in their classroom. A number of people stated that they would use everything. The few who stated reservations about using the information gave reasons that were individual ones, not repeated by any other respondent, such as, "An audiologist does all our evaluations."

In response to the question "Who would you recommend take this workshop?", the most frequently mentioned groups were teachers and aides working with the severely handicapped. The next most frequent response was all special education teachers. Nearly everyone involved with special children was named at least once however, including administrators, parents, speech therapists, student teachers, and audiologists.

In summary, not only did workshop participants acquire new knowledge as a result of the workshops, but also they evaluated the content of the workshops as relevant to actual classroom practice and appropriate for numerous different disciplines working with the severely handicapped and deaf blind.

Informational Presentations. These presentations were short (1½-2 hour) overviews of the project practices and products. Their purpose was to increase awareness and to disseminate knowledge about the project to a wide national audience. Presentations included use of the slide show and videotapes showing innovative educational practices. At all of these presentations, outlines of the two manuals under development were disseminated. Table 12 presents the location and estimated audience size and type for these informational presentations.

The total number of attendees at these presentations was 689. This audience total includes teachers, aides, therapists, parents, administrators, and teacher trainers. Consumer satisfaction questionnaires were occasionally distributed and outcomes were consistent with the workshop evaluations, ranging from 4.2-4.8 on a 0-5 scale for relevance and quality.

5) DISSEMINATION

The project engaged in a wide variety of dissemination activities, including training workshops, presentations, integration with the severely handicapped teacher training program at San Francisco State University, and publication of

Table 12

	LOCATION	N	AUDIENCE
Year 1:	Annual California Development Center Conference Asilomar, CA	50	SH/DB teachers and administrators
	California Association of Behavior Analysis Stockton, CA	60	Direct service personnel, teachers and aides, administrators, teacher trainers
Year 2:	American Association for Behavior Therapy San Francisco, CA	150	Direct service personnel, teacher trainers
	The Association for the Severely Handicapped Chicago, IL	100	Direct service personnel, teachers, aides, therapists, administrators, teacher trainers
	Annual California Development Center Conference Fallen Leaf Lake, CA	60	SH/DB teachers, administrators
	Outside Evaluation Consultants - Project Site	6	Evaluation consultants, district administrative personnel
Year 3:	Anchorage School District Anchorage, AK	50	SH teachers, aides, speech therapists, administrators
	Project Officers from USDE, Project Site	6	Project officers, D/B regional center administrators, district administrators, parents
	The Association for the Severely Handicapped Baltimore, MD	50	SH/DB teachers, aides, therapists, parents, teacher trainers,
	Deaf Blind Regional Center Conference San Diego, CA	35	D/B teachers, parents, administrators
	Annual California DCH Conference Fallen Leaf Lake, CA	80	SH/DB teachers, aides, administrators
	ENCORE Personnel Omaha, NE	12	Direct service personnel, house parents
	California School Nurses Organization San Francisco, CA	80	School nurses, assessment personnel
	TOTAL N =	689	

various articles, research reports, and project products.

Dissemination through training workshops and presentations is discussed in detail under Section 4. A total of 22 day long workshops in vision, audition, and functional sequencing were presented to 304 (unduplicated count) severely handicapped/deaf blind inservice and preservice teachers, psychologists, visually handicapped teachers, and therapists. A total of 13 presentations were made to national audiences including teachers, parents, aides, administrators, and teacher trainers. The total number of attendees was over 600. Written materials (excerpts from the vision and auditory manual) were disseminated at all workshops and presentations.

Replication of the project's model classroom was in itself not a dissemination goal, as the project was committed to a non-categorical service delivery approach for these students. However, replication of project practices was a major dissemination goal. Based on a criterion of one project staff member having observed a project practice or procedure (e.g., assessment program, use of functional sequencing, etc.) being used in the classroom, 19 replication sites were documented statewide. In addition, Training Resource Group, a statewide inservice training mechanism for severely handicapped teachers, has been contacted about incorporating project procedures into their inservice training modules and workshops to ensure broader statewide dissemination.

Dissemination of project products includes the following: 4000 copies of the Auditory Manual will be published by Words and Pictures Press. A total of 400 copies of the Vision Manual have been reproduced and will be disseminated at no cost through Regional Deaf Blind Centers, announcements in The Association for the Severely Handicapped newsletter, and announcements in Special Net.

Written dissemination also includes the following publications:

Sailor, W., Guess, D., Goetz, L., Schuler, L., Utley, B., and Baldwin, M. Language and the severely handicapped: Deciding what to teach to whom. In W. Sailor, B. Wilcox, and L. Brown, Methods of instruction for severely handicapped students. Baltimore: Paul Brookes, 1980.

Goetz, L., Baldwin, M., Gee, K. and Sailor, W. Classroom based sensory assessment procedures for severely handicapped students: Case studies of a stimulus transfer paradigm. Analysis and Intervention in Developmental Disabilities, 1981, in press.

Sailor, W. and Baldwin, M. The Bay Area Severely Handicapped Deaf Blind Project. Counterpoint, November, 1981. Falls Church, VA. (circulation 20,500).

Three additional research reports are currently in preparation for publication submission to Journal of the Association for the Severely Handicapped, Analysis and Intervention in Developmental Disabilities, and Journal of Applied Behavior Analysis. (See reference notes.)

The project also produced 30 minute videotapes on the following topics:

1) Vision Assessment (Sections I-III of the Vision Manual)
2) Auditory Assessment (Informal and VRL/OMR programs)
3) Vision programming and error correction procedure
4) Innovative practices (functional sequencing)

These tapes were used as part of all training workshops. A slide show consisting of 36 slides was developed and used for numerous statewide and national presentations.

CONCLUSIONS

The Bay Area Severely Handicapped Deaf Blind Project documented that numerous data-based, task-analytic, operant assessment procedures and instructional programs were highly effective in accomplishing sensory evaluation and instruction. This population of students continues to provide a tremendous challenge to educators in terms of effective educational services. The products and outcomes of this project, which have been widely disseminated through workshops, presentations, and publications, should substantially increase the confidence with which teachers can determine the status of a student's hearing and vision. While numerous questions remain concerning optimally effective strategies for teaching functional hearing and vision use, innovative practices developed by this project provide a critical starting point. As a result, students who have long been underserved and/or poorly served due to the complexity of their handicaps, can now more accurately be assessed and provided with instructional programs which are specifically designed to improve functional vision and hearing use.

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